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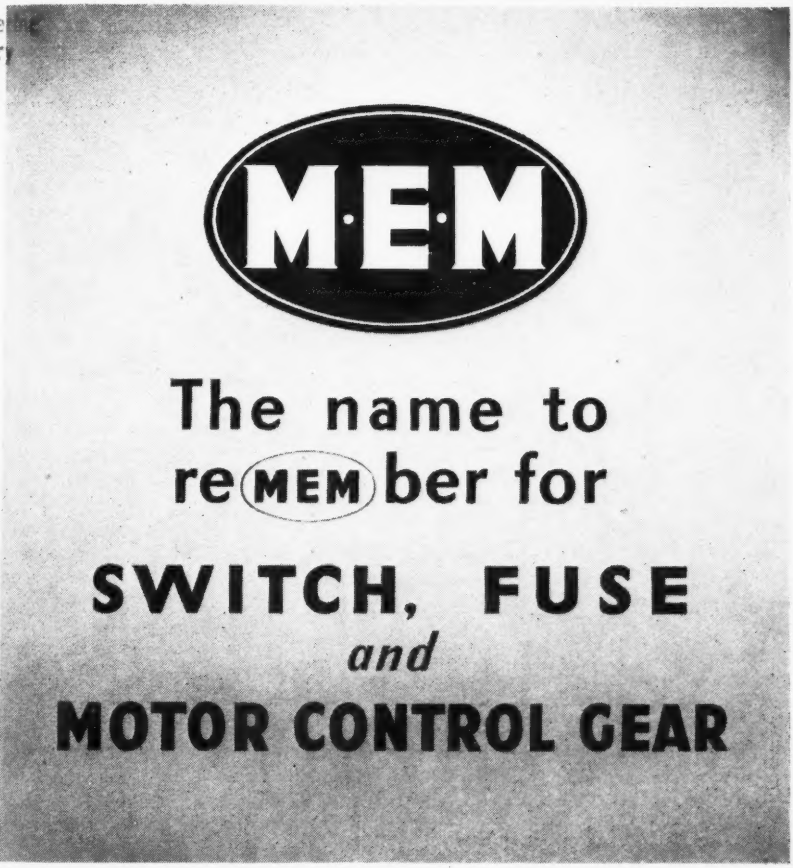

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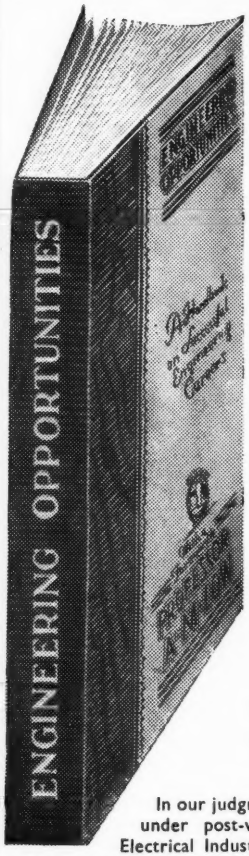

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ELECTRICAL REVIEW

Volume CXXX . **No. 3353**

Friday, February 27, 1942

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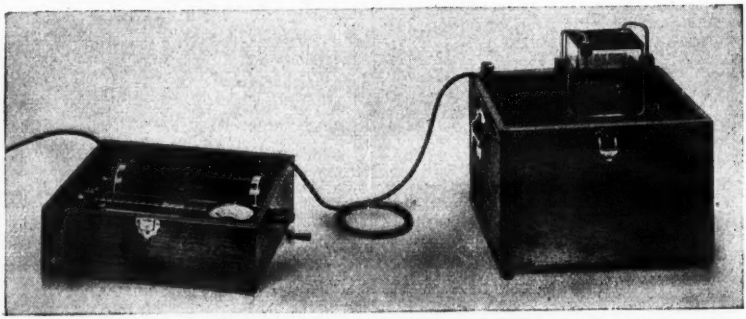

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXX. No. 3353. FEBRUARY 27, 1942 6d. WEEKLY

Misplaced Skill

The Armed Forces' Needs and Resources

WITH the rapid expansion of our armed forces to many times their peace establishments, a large number of men have inevitably found themselves (or perhaps have chosen to place themselves) in positions where their full capabilities are unused. And once they have been fitted into the military machine it is not easy to bring about large-scale transfers without serious dislocation.

At the same time, the need for utilising all available skill and for satisfying the calls from both civilian industry and the mechanised forces demands that serious attention shall be paid to the subject. This is the task of Sir William Beveridge's Committee on Skilled Men in the Services, whose second report is reviewed in this issue.

The Committee's first report dealt mainly with the recruitment of technical personnel to the forces and admitted that at least part of the stated requirements should be met from civilian sources. The question of the degree to which skilled men already serving were being fully and properly employed was reserved for this second report.

Examination of Cases

The Committee adopted the method of interviewing men whose names were obtained from two important electrical engineering firms, three railway companies and three trade unions, including the Electrical Trades Union. It is admitted that men on the employers' lists who appeared to be properly employed were in general passed over and the trade union lists covered men as to whose use complaint had been made to the unions. In all the lists there was an undue predominance of skilled men, relatively to semi-skilled and unskilled.

It may therefore be thought that the "cross-section" thus obtained does not give a fair picture of the actual conditions, but it is noticed that in its memorandum on the report the War Office does not insist on this.

Civil and Military Standards

Dealing generally with the Committee's report, the War Office considers that the standards of civilian industry have been applied to the fighting machine, a process which cannot be carried very far. Already, it is stated, 80,000 men have been combed out for training for employment appropriate to their aptitude and 58,000 officers and men have been released from the Army, the bulk of them highly skilled.

The proposed formation of a Corps of Mechanical Engineers is not looked upon too favourably, but the matter is being thoroughly examined. Enlistment for the Army instead of for corps, the War Office says, is a consummation it has devoutly desired, and is already experimenting with, but here again there is a fear of dislocation.

It will be seen that both the Committee and the War Office are doing their best, according to their somewhat different lights. Whether the situation is as bad as the report may suggest and whether the proposed remedies are feasible or not may

be debatable. Nevertheless, useful service has been done by the Committee in bringing the matter forward and no doubt all possible further action will be taken to diminish, if not eliminate, any "square-peggedness" which exists in the forces.

Their Own Choice

REFERENCE is made on the preceding page to men who have chosen to place themselves in Army units in which their skill is not fully used. These are largely men who have become "fed up" with their civilian jobs and have rather welcomed Army life as a means of escape. Then there are many others who have felt that their peacetime work offered little scope for advancement and have got into branches of the Service in which they can secure training in other directions which they consider will be more lucrative in civil life. The Beveridge Committee refers to the first class and agrees that this attitude has militated against the efforts which the Army authorities have made to transfer men to more suitable work.

The Electric Spark

NOT for many years has a new electrical theory relating to so fundamental a matter as the mechanics of spark discharge been forthcoming. Last week's ordinary meeting of the Institution of Electrical Engineers was therefore an event of unusual importance not only from the scientific standpoint but also on account of its bearing on the work of high-voltage engineers and on the ignition of internal-combustion engines. The author, Mr. J. W. Meek, has taken most profitable advantage of the opportunity afforded him by an international scholarship to collaborate in the United States with so eminent an authority as Professor L. B. Loeb, himself also formerly a student in Great Britain. Mr. Meek is, by the way, a Graduate I.E.E., which well demonstrates that this grade includes men of high calibre.

Liberal Education

PRINCETON University recently celebrated the fiftieth anniversary of the graduating of the first class in the first formal school of electrical engineering in the United States. The founder of the school was Professor Cyrus F. Brackett, and it is stated in a biography that in the courses politics, law, economics, religion, industrial processes and other things were brought to the students' attention. Many British electrical engineers will agree with the views of the *Electrical World* that "it seems too bad that this early attention to the other phases of human knowledge with which engineers must come in contact was to be later forsaken for more and more 'practical' courses. We sometimes wonder if engineers might not have been better able to show leadership in solving our social, political and economic problems had they been subjected to less shop work and more of the broader components of human knowledge during the formative years of college education."

Co-ordinating Practice

COLLABORATION between bodies working in a common field with a view to securing consistency in their regulations has not always been effective in the past. In dealing with constructional matters, the Ministry of Works has cut the Gordian knot by accepting responsibility for co-ordinating the codes drawn up by the various interests concerned. In thus providing a single channel for the production of all codes of practice the Ministry will receive the assistance of a committee of the leading technical institutions. While the agreed codes will not be obligatory, as Mr. Hugh Beaver, Director-General of the Ministry, made clear at the recent luncheon of the Association of Supervising Electrical Engineers they should possess sufficient authority to ensure general acceptance as the minimum level of good practice.

Pool Oil

NON-SLUDGING qualities of transformer oil have been rated much too highly in the past, and quite half the quantity in service two years ago, it was estimated, was of the highly refined Grade A. Moreover, the tests prescribed in B.S.S. 148, now under revision, seem to encourage its use. Grade A is not only more expensive than Grade B but is more prone to a greater evil than sludge, namely acidity (see Meyer, I.E.E. Journal, April, 1940, and Coursey and Gough, ELECTRICAL REVIEW August 29th, 1941). Recent reports indicate that "pool oil," which is equivalent to Grade B, is proving very satisfactory, so perhaps the enforced experience of its merits will go far to destroy a myth.

After a Raid

Rapid Repairs and Restoration of Supply

Last week we dealt with the effects of bombs on electricity supply systems. We now give further advice from electrical engineers in badly affected districts on the most efficacious methods of restoring supplies

RESTORATION of electricity supplies after an air raid is very much simplified by having the area split up into sections, which if the area is large enough may well be self-contained and each have its own emergency repair gang operating individually. If the raid is a severe one it may be considered advisable for an engineer to visit some of the damaged areas while the raid is still in progress in order to see what work will have to be done in the morning. In any case an inspection of the damage should be made as soon as the raid is over.

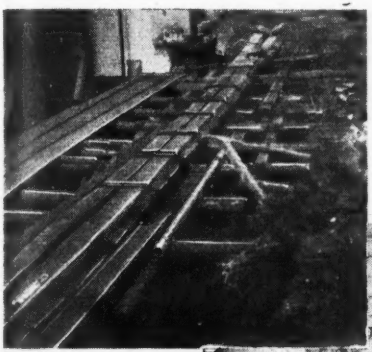
In repairing mains a policy of ruthless amputation of faulty sections is generally found to be the most successful course to adopt. Under normal conditions cable saving has always been of paramount importance with distribution engineers, but under "bomb" conditions experience has shown the necessity for "cutting and sealing" at the most convenient place as quickly as possible, as in most instances it is found that craters quickly fill with water from damaged mains.

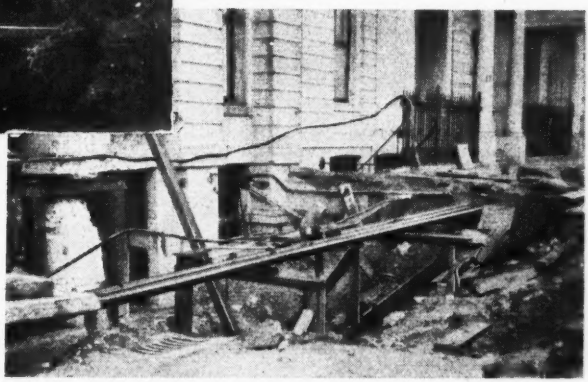
Most cables are capable of being supplied from either end and it is most desirable to get all sound sections of the system in working order again at the earliest possible opportunity. In all probability premises on each side of the crater will not be requiring supplies for a time at any rate, but special arrangements can, of course, be made to supply important consumers.

Not always, however, in fact we might say comparatively seldom, does the urgency of restoring supplies justify the undertaking of temporary cable repairs. While special emergency joints utilising cold-filling compound have in actual practice apparently justified their makers' claims, the general consensus of opinion is that they are not often warranted on the score of saving a few extra hours and should be used only when immediate recommissioning of the cable is essential, that there are other methods almost if not quite as quick, and that they are considered to be "rather an expert's job."

It must be emphasised strongly that while some manufacturers, we believe, claim that their cold-filling joints are permanent, these joints are primarily for emergency use and permanent repairs usually have to be carried out later.

The most difficult part of the joint is said to be the sealing of the ends to make them watertight, though apparently some care is necessary in the mixing of the compound.

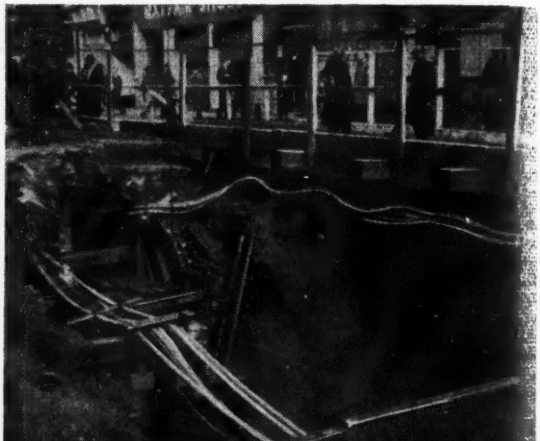




Above: Scaffolding supporting a new length of cable installed across a crater; the cables are covered by boards as a protection against further damage by shell splinters, etc. Right: High- and low-voltage cables supported across a crater in steel pipes

Failure to appreciate the necessity for very efficient mixing was in fact the cause of the breakdown of a 11-kV joint after three months, the only experience of one undertaking. Another undertaking has come to the conclusion that the use of these joints is advantageous for cables of 33-kV pressure and higher, considering the saving of approximately a day and a half in the repair work worth while.

A third undertaking, one of those claiming to to be able to make its own form of emergency joint equally well and almost as quickly, has adapted its normal jointing procedure to meet the emergency conditions, cutting out all "frills" and making good use of "Denso" anti-corrosion tapes. It is possible for a jointer to make two of these joints in a day and an experimental test joint with no protection and no lead sleeve stood up to 100 kV when immersed in water. To mention but one other practical scheme employed for repairing 33-kV cables, the preparation of a joint sleeve beforehand (including the heating-up of the compound, drying out and sealing), reduces work on site from about 30 to 6 hours. Filling is done by bringing the compound up to a temperature of about 90 deg. F. and maintaining a vacuum for 5-10 minutes instead of the usual half an hour and a pressure for about half an hour instead of the customary twelve hours.



Use of temporary wooden bearers supporting h.v. feeders in a large crater, and (left) damaged h.v. cable temporarily replaced by a cable suspended from the wall of the building on the right

In the bridging of cables across craters, many devices have been widely adopted, such as the use of scaffold poles as supports, and the suspension of the cables temporarily on adjacent walls. Another scheme which has much in its favour is the utilisation of "Meccano-like" steel structures to support the cables temporarily while other parties requiring access to the crater attend to their work. (The electricity undertaking, by the way, is nearly always the last to be allowed to complete its work in a

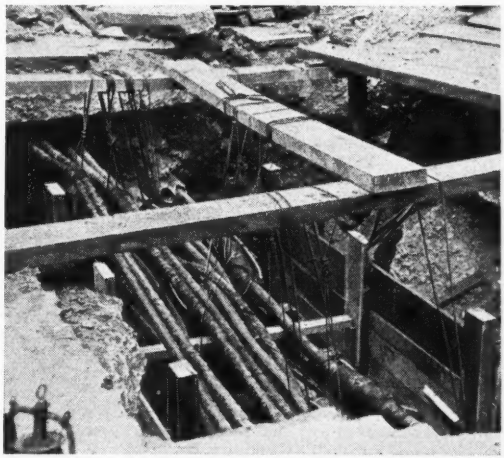
crater, but perhaps this may be taken as a feather in its cap on account of the speed and efficiency with which it carries out its emergency work.) These steel structures which are generally covered with boarding to give the cable protection against stray splinters of anti-aircraft shells, etc., are rapidly erected and leave an almost clear space around for other work to be undertaken.

In carrying out emergency repair work it is essential for the operating staff to be well acquainted with all the by-passes and for this reason the amount of assistance that can be rendered by other undertakings with which a co-operative scheme has been arranged is generally limited principally to such straightforward jobs as disconnecting services to consumers in a whole damaged district. Personnel imported from outside has also to be housed and fed—not always a simple matter after a severe raid.

To facilitate repairs it is very necessary to have accurate plans of mains and in view of the possibility of landmarks in the form of buildings disappearing completely, the location of cables should be given from the centre of the roads or from the kerbs. By having draughtsmen at work constantly keeping plans of streets right up to date, the repair gangs can go straight out to the job without delay immediately it is daylight.

With regard to the speed with which it is possible to restore supplies, most undertakings reckon to get a high-voltage mains in commission again, at any rate temporarily, the day following a raid. As a typical example we may quote the case of six 33-kV cables which were temporarily repaired within 24 hours despite the handicap of a considerable delay caused by leakage from nearby fractured gas mains (this is a frequent occurrence). Although in two separate positions, permanent repairs were completed in a fortnight.

The importance of having *all* incidents reported to the electricity undertaking's control centre whether they apparently concern the undertaking or not is emphasised by several engineers, and it may also be necessary to establish some sort of clearing house to cope with the innumerable telephone calls and other messages that are liable to inundate the undertaking after a raid. With such a system for obtaining and sorting out the information available, it is thus possible to notify with the minimum of delay any department which may be concerned, even remotely. It is stressed that it is just as important in the interests of the undertaking for representatives of the department responsible for the domestic appliances and meters to be on the scene of the damage, as for the mains staff. It is remarkable how quickly apparatus, as well as the contents of the prepayment meters, disappears after a raid, and it is useless to wait for lists of damaged property to come in from official sources. Some engineers advocate taking the initiative and immediately reports of serious damage are received "sending round and removing any electrical equipment they can lay their hands on." In adopting this procedure there is, of course, a risk of collecting apparatus which does not belong to the undertaking, but the authorities would in the circumstances undoubtedly take a broad view.



Box being built round h.v. joints in a bomb crater

Practically all undertakings have now come to the conclusion that there is nothing to be gained by attempting anything in the way of actual repairs (apart from isolating bad sections of the system and restoring supplies to sound sections by means of alternative switching) while the raid is still in progress except in very special circumstances. Apart from the unwarranted risk to personnel, little can be done until daylight. Much time and money is spent unnecessarily, it is felt, on having emergency repair gangs on duty throughout the 24 hours and without any question of slackness it has been proved in practice that a much more satisfactory arrangement is to have the men standing by in their own homes and call them up by telephone (or even by messenger) only when actually needed. Not only are the men thus kept in better shape and their off-duty periods interfered with as little as

possible, but they are well dispersed and there is less risk of a whole gang of highly-trained being put out of action by one "incident."

The composition of the emergency repair gang or gangs and their equipment varies somewhat from undertaking to undertaking. Generally, however, they consist of a dozen or so engineers, fault-finders, jointers, labourers, etc., fully equipped to deal with, say, half a dozen joints. When not required for dealing with bomb damage they are available for doing any odd repair or extension jobs that may come to hand. If the area is a large one, decentralisation of these gangs into separate self-contained units covering particular areas has an advantage, while the organisation of special fire-fighting units is also advisable.

One of the major difficulties confronting supply engineers after a raid is often transport. The normal passenger transport is generally interfered with considerably, and there must be no risk of large numbers of the undertaking's own vehicles being put out of action. For this reason it is a sound scheme to secure their dispersal by permitting all engineers to take their cars home. This policy of dispersal is, of course, most necessary for all moveable property and stores, and some undertakings even go so far as not only to split up their stores in their own districts, but also to maintain stores outside these areas as well. Women are being engaged to a considerable extent in repairing apparatus that has been damaged.

Much has been written, but more has been left untold, of the heroism of repair staffs in the carrying out of their duties in the face of danger. All the engineers with whom we have spoken have nothing but admiration for the way in which their men have carried on unflinchingly and without complaint at all hours of the day and night, in any weather and regardless of danger. In addition, a word might well be put in for their patience, for there is every excuse for being disheartened by seeing one's good work just completed undone again, perhaps only a few nights later by another "incident." Such a case occurred, for example, when a delayed action bomb, unnoticed in a crater, exploded just after repairs had been completed.

We extend our thanks to all the engineers whose undertakings we have visited for their assistance in the preparation of this article.

Forthcoming Events

Institution of Electrical Engineers.—*Meter and Instrument Section.*—Friday March 6th, 6 p.m. London. Paper: "DC Amplifier and its Application to Industrial Measurements and Control." by Mr. D. C. Gall.

Wireless Section.—Wednesday, March 4th, 6 p.m. London. Paper: "Public Address Systems," by Mr. S. Hill, M.Eng. Tuesday, March 10th, 6 p.m. Informal meeting on "Frequency Stability of Tuned Circuits: (*a*) Materials, (*b*) Components and (*c*) Complete Assembly." to be opened by Messrs. G. P. Britton, C. W. Eggleton and A. H. Cooper, respectively.

Transmission Section.—Wednesday, March 11th, 6 p.m. London. Paper: "Short-circuit Rating and Testing of Current-Limiting Reactors," by Messrs. J. G. Wellings and R. V. Wheeler.

Installations Section.—Thursday, March 12th, 6 p.m. London. Paper: "Electrical Industrial Applications," by Mr. L. C. Grant.

Devon and Cornwall Sub-Centre.—Saturday, February 28th, 3 p.m. Royal Clarence Hotel, Cathedral Yard, Exeter. Chairman's address by Mr. C. Culmer Hodges on "Post-War Reconstruction," to be followed by discussion.

Sheffield Sub-Centre.—Saturday, February 28th. Luncheon followed by discussion on "Voltage Regulation in Distribution Circuits," to be opened by Mr. J. H. H. Teece, B.Sc.

North Midland Students' Section.—Saturday, February 28th, 2.30 p.m., Hotel Metropole, King Street, Leeds. Paper: "The Automatic Control of Substations." by Mr. R. W. Blythe.

South Midland Centre.—Monday, March 2nd, 6 p.m. James Watt Institute, Birmingham. Paper: "City Distribution by Solid Low-Voltage Networks," by Mr. B. Wood, M.A.

Mersey and North Wales (Liverpool) Centre.—Monday, March 2nd, 6 p.m. Liverpool Royal Institution, Colquitt Street. Paper: "Voice-frequency Signalling on Trunk Lines," by Messrs. W. G. Radley, Ph.D.(Eng.), and E. P. G. Wright.

London Students' Section.—Friday, March 6th, 6.45 p.m. Comedy Restaurant. "Stag" supper.

North-Western Centre.—Saturday, March 7th, 12.45 for 1 p.m. Engineers' Club, Albert Square, Manchester. Wartime luncheon.

North-Eastern Centre.—Monday, March 9th, 6.15 p.m. Neville Hall, Westgate Road, Newcastle-upon-Tyne. Paper as for Mersey, etc., Centre. *Students' Section.*—Friday, March 13th, 6.30 p.m. Neville Hall. Joint Meeting with N.E. Coast Institution, and the Students' Lecture by Dr. D. S. Anderson, B.Sc., on "The Failure of the Technician in his Role as a Citizen."

Scottish Centre.—Thursday, March 12th. Edinburgh. Paper: "Electrical Industrial Installations," by Mr. L. C. Grant.

Dundee Sub-Centre.—Thursday, March 12th. Annual dinner.

Electrodepositors' Technical Society.—Tuesday, March 3rd, 5.15 p.m. James Watt Memorial Institute, Birmingham. Paper: "Anodising in Wartime (with special reference to Sulphuric Acid Process)," by Mr. A. W. Wallbank. Monday, March 9th, 5.30 p.m. Northampton Polytechnic, London, E.C.1. Paper: "Solvent Economy in Trichlorethylene Degreasing Plants," by Mr. W. F. Jesson.

Association of Mining Electrical & Mechanical Engineers.—*West Wales Branch.*—Saturday, March 7th, 5 p.m. Mackworth Hotel, Swansea. Discussion on "Report of Departmental Committee on Amendment of Electricity Regulations," to be opened by Mr. J. A. B. Horsley.

Stoke-on-Trent Association of Engineers.—Saturday, March 7th. Paper: "Steam Turbines Applied to Industrial Plant," by Mr. J. E. Lee (Richardsons Westgarth-Brown Boveri, Ltd.)

Electro-Deposition Trends

A Survey of Recent Advances

By T. Thorne Baker, M.I.E.E., F.Inst.P.

THE electro-deposition of one metal on another must be regarded as having many functions. One of them is purely decorative, for example the coating of household utensils with silver or gold, but equally important is the protection afforded against atmospheric attack to iron sheet and wire, or to internal machine parts and wireless set chassis by a plating of cadmium or zinc. New lines of decorative work are on the horizon, where coloured deposits are plated on to metal and exceedingly thin more or less transparent platings on a scratched base admit of very fine interference colours being obtained. More recently attention has been focused on the electro-deposition of metals on plastics, while the industrial application of the electro-deposition of rubber continues to expand.

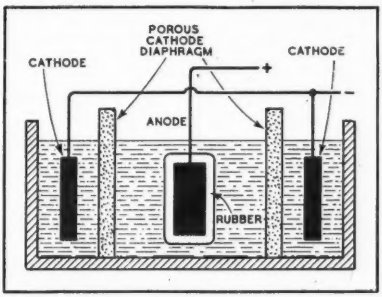
Much has been done recently to improve the quality of metal deposits. The author describes developments in technique with this in view

The very simple relationship given us by Faraday that $W = C.z.T$, where W is the weight of the metal deposited, C the applied current, z the electro-chemical equivalent, and T the time, has necessarily to be amplified somewhat according to processing conditions, but it is in the quality of "W," its physical structure, continuity and evenness of distribution that the greatest progress has been witnessed, although in the design of plant, more recently of automatic plant, substantial advances have taken place.

The Electrodepositors' Technical Society records the "impact of science" on electroplating generally, and has drawn attention to the standardisation of the methods of controlling the constituents of the various electrolytes used in the industry, the co-operation of engineers and chemists in the design of modern plant, and the elucidation of many plating phenomena which are still too little understood.

An illustration of the trend of progress is the case of nickel plating for which the preparation of the "work" prior to deposition has received special attention. The amount of cold work done on the metal surface before cleansing, for example, plays an important part in adhesion. The ideal cleansing bath must emulsify and peptise as well as saponify, it must be a good wetting agent, and must not cause surface staining. In the preliminary cleansing treatment, for example with tribasic sodium phosphate, the detergent properties can be considerably increased by addition of sodium hexametaphosphate. Anodic etching, to-day largely employed, provides in addition to a "tooth" for the metal deposit, a scrubbing action by the gas liberated at the work, temporarily the anode, which is highly effective and may be said to be almost standard practice. In the cleaning of cold rolled ferrous strip, which is passed continuously through a bath between upper and lower electrodes, the strip functions as cathode in a first degreasing bath, and then as anode in an etching bath of about 6 per cent. sulphuric acid.

Defects due to pit-forming gas bubbles have been greatly reduced by lowering suitably the surface tension of the plating bath, for which some of the naphthalene sulphonic esters have proved particularly valuable. As regards the continuity of the deposit, or lack of porosity, its hardness and tensile strength, pH control of the bath plays an important part. Modern methods of pH measurement, either with portable electrometric apparatus or with continuous-flow electrode systems, have become more or less a part of up-to-date equipment, and are proving of practical assistance in the maintenance of consistent results and the minimising of operational costs.

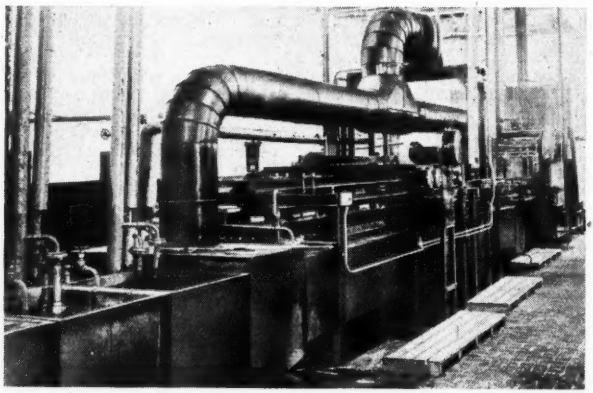


Simple diagrammatic representation of rubber deposition bath

The use of carburised electrodes represents another advance in nickel plating, the anode surface being covered with a paste containing free carbon. Useful in producing decorative designs in nickel is the anodic treatment of the

work. A lustrous finish can be obtained on matt nickel deposits by electrolytic treatment with the work as anode in fairly concentrated sulphuric acid; between 15 and 30 seconds treatment is given at a current density of about 250 A per sq. ft.

Chromium plating has come into such general use that it may be regarded as a "household" process in the industry. Its application to printing is perhaps a good instance of its extending uses. The copper-plate rollers used in the printing of postage stamps are largely faced with chromium; the technique is in use at the Royal Mint, London, and at the Bureau of Standards, Washington. It is natural that the wartime need for chromium in the steel industry should cause the rapidly widening applications of this metal to electro-deposition work to suffer a serious set-back.



Semi-automatic plant for hard-chrome plating, incorporating Canning "Rotomatic" vat

In the tinned foods industry porosity is a deciding factor. If the sheets to be plated are rough, uneven or porous, plating is useless as against the more generous application of molten metal. The most satisfactory results have been obtained probably on hot-rolled plates which have been given a cold pass prior to tinning. While excellent for copper and steel cooking kettles, electric refrigerator coils and similar work, tin deposition is unlikely to replace hot tinning for a great many purposes.

Silver on Non-metals

Silver deposition on non-metallic surfaces in baths containing cane sugar, formaldehyde, Rochelle salts, etc., is now regarded as relatively uneconomic. Measurements described in the *Journal* of the Electrodepositors' Technical Society in May, 1941, indicate that a final thickness of about 0·00006 in. is obtained with a sugar-cane silver nitrate bath, which may be compared to a thickness of 0·00001 in. of the thinnest silver foil obtainable. In silver plating proper the use of carbon disulphide appears to remain the most effective addition agent.

Electroplating proper with the work as anode seems something of a *volte face*, but in the case of the electro-deposition of rubber it must be remembered that latex behaves as a typical negatively charged colloid; it can be coagulated by positive ions and can be transported to the anode in an electric field. The rate of deposition can be very rapid. Thus whereas a current density of 10A per sq. ft. would deposit 1 oz. of nickel per sq. ft. in 2½ hours, 80A per sq. ft. would deposit the same weight of rubber in 17 seconds. The action is thus approximately 68 times more rapid. Voltages used in practice range from 10 to 100 V, depending on the current density and size and character of the work. Considerable development in the delicately balanced latex solution has been seen.

Another example of anodic deposition is the subject of a recent patent specification for the electroplating of resin films. This is carried out in an aqueous alkaline solution of the resin, the work being the anode. Hydrolysed castor oil is used as a plasticiser. Films of shellac deposited on aluminium are being employed as condenser plates.

Improved Addition Agents

On the chemical side much has been done in the way of improved addition agents for various types of bath, especially with some of the more recently applied organic substances. Thus polyvinyl alcohol has been used in nickel coating, in cadmium, zinc, tin and copper baths; for zinc the addition of a mixture of a 1 per cent. solution of borax with a 2 per cent. solution of polyvinyl alcohol has been used according to a recent patent of du Pont de Nemours (E.P. 499, 343).

More particularly have the chemical reactions been investigated from the pH standpoint. The selection of the most suitable current density, for example, requires consideration of pH. Reverting to nickel, the pH of the plating solution is the most important factor in determining the physical properties of the deposit. A low pH with a high temperature and vigorous agitation favour rapid

deposition, but as the pH rises so the tensile strength and hardness of the plating increase, while elongation or ductility decreases. The current density must be reduced when the pH rises above 5, pH 5·2 - 5·8 being the most satisfactory. By means of automatic regulation, previously referred to, it is possible to introduce nickel carbonate into the bath when its pH falls below 5·2, while when it rises above that figure sulphuric acid is let in. In anodic treatment of magnesium and magnesium alloys for anti-corrosion, using a current density of 1 to 100 A per sq. ft. the pH must be preferably maintained between 2 and 5; and so on.

On the mechanical side increasing attention is being paid to filtration of the deposition baths, as it has been found to be of little value unless the very finest particles are removed. Any pump must be steady in action and give an adequate pressure of, say, 80 lb. per sq. in., must resist corrosion and be immune from contamination. The addition to the baths of finely divided metals between lead and magnesium in the electromotive force series has been recommended to remove traces of electropositive metals, such as lead or copper.

Addition of piperin, coumarin, furfural alcohol, etc., to a zinc bath has been claimed to improve the brightening action considerably. Special apparatus has been designed by du Pont de Nemours Co. for checking the brightness of such deposits and making accurate comparisons. A beam of light reflected from the surface of the finished work is directed upon a photo-electric cell and the degree of finish accurately estimated. For silver-on-nickel mirrors for reflectors, a novel method of producing extremely thin coatings of the plated parts has been evolved. This consists in rotating the plated part round a central axis at a high speed, such as 2,500 to 3,500 RPM. The reflectors are first specially washed in a solution containing alcohol and gelatin. In this way nickel deposits of 0·00002 in. are being obtained on which an excessively thin coating of silver can in turn be deposited.

It has already been remarked that priority demands for chromium have for the time being greatly restricted the practice of ordinary chromium plating. In its place there has come a wide application of hard chrome deposition. With a special electrolyte, for which the research department of Canning & Co. is responsible, deposits of extraordinary hardness with perfect adhesion can be obtained by the use of a specially balanced electrolyte with a very high current density. Plug, ring and gap gauges, drills, milling cutters and files, stamping and forging dies and engine crankshafts are being plated with hard chrome. A particularly important application is to the building up of worn parts and the salvaging of costly and valuable components which might otherwise be rejected because of defects in machining. By the way, a semi-automatic plant for hard chromium plating in considerable thicknesses can be obtained.

American Porcelain Insulator Design

HOW the changing needs for electrical insulation are being catered for in the United States has recently been commented upon by Mr. R. L. Whitney, of the Westinghouse Electric & Manufacturing Co.

In remarking upon the tendency to equip new transmission and distribution lines with power insulators designed to minimise interference with radio reception, he has revealed that three-quarters of all line and station insulators made at the company's works at Derry, Pennsylvania, and Emeryville, California, are of this type. Their conducting glaze compositions have had to be changed to enable materials less vital to national requirements to be employed without decreasing their effectiveness and permanence. Some 9,000 insulators are said to have been shipped from these works every week in fulfilment of an unusually large single order for 45,000 10-in. insulators. Blanks have been extruded for what are described as the largest one-piece porcelain parts ever made by the wet process, eventually forming cylindrical coils of 17.25 in. diameter by 46.25 in. long.

The co-ordination of station insulation has become of increasing concern, while dependability has been emphasised to the extent of causing bushings to be hermetically sealed and soldered into transformer and oil-switch tanks as well as on to outgoing conductors, for all voltages up to 69 kV, thus abolishing leaky gaskets and spun caps.

An example of adaptability to changing needs has been the production of "Prestite," which is a substitute material termed plastic because it can be formed accurately into intricate shapes, thus rendering design compromise unnecessary, but it is made of exactly the same ingredients as porcelain and is fired in the same kiln with it.

"Prestite" is said to be mechanically as strong in compression as porcelain made by the wet process, and not to deform at temperatures that would destroy phenolic plastic substances, to have an equivalent dielectric strength, to be impervious to moisture and not to be liable to surface charring when subjected to repetitive flash-over. Dimensional accuracy and absence of warpage have enabled the new material to be utilised for parts of engine ignition systems, for tap-changer plates in transformers, for enclosing fused cut-outs, as third-rail traction insulation, pump valve seats and in substitution for aluminium in the storage reservoirs of water coolers.

Keeping Up Interest

Advice to Jaded Manufacturers

By "Sala"

RESTRICTED supplies of raw materials, labour difficulties, the worry of maintaining the production plant in face of overwhelming obstacles, the constant review of costings and the daily insatiable demands of customers for bigger and bigger deliveries has made apparent a general lack of enthusiasm for their products amongst manufacturers.

They have suffered so much from the effects of all these problems during the last two years that it is not surprising that they have resigned themselves to a dull, daily grind which has as its sole aim the producing of the maximum quantity of goods from the raw material obtainable in the hope that their effort will at least satisfy in some small way that never-ending clamouring of their customers for more and yet more.

Substitute raw materials have been investigated and adopted where possible, production has been studied and re-studied, until it appears that there is nothing at all more that can be done. Man-power demands have reduced the selling staff to almost nothing but no effort is needed to sell the goods and competitors do not seem to exist. The manufacturer feels that all he can do is to fight for his share of raw materials and keep up the daily, uninteresting task of placating his customers by sharing his goods amongst them in the fairest possible manner with due regard to priority.

Wartime conditions are apt to depress manufacturers who in peacetime had to keep "on their toes." They can still maintain that spirit and help their customers even in present circumstances

Maintenance of Contact

That valuable direct contact which he had with all his customers through his representatives is gradually being lost, and, as a result, his daily business life under existing conditions becomes extremely monotonous. This state of affairs is to be deplored. It is a great pity that any manufacturer should lose his zest and enthusiasm for selling and talking about his products. The ability to ensure that his productions were always kept in the limelight, their strong selling points and quality advantages constantly pressed home, went far to assist his success in the more competitive days. It was this constant study of his products for new selling points and new quality advantages which kept the manufacturer enthusiastic.

In spite of all his present difficulties there is much that the manufacturer can say about his products—much that can materially assist each of his customers and, at the same time, further the general war effort. The total elimination of waste power and effort, the strict conservation and full and correct usage of every electrical item, are not only necessary but vitally essential in these times of short supply.

What excellent scope exists, therefore, for each manufacturer to build a new and telling story of how waste power and waste effort can be eliminated and how correct usage of his products will effect the greatest savings in materials. In other words, let the manufacturer show his customers how they can obtain better value, better results and the longest possible life from each item of electrical equipment which he produces. He can show them how items of electrical equipment can be made to go farther and how their correct usage will add to the life of other valuable and vital machinery. It is not suggested that the information should be presented merely as an excuse for costly and elaborate advertisement; it can be presented in a business-like manner aimed at genuinely assisting the users of the products.

All manufacturers of electrical equipment must realise that the users of their products have vitally important production plants to maintain and that they are constantly on the look-out for any idea, suggestion or technical advice which will help them to keep their plants running at maximum capacity.

Therefore manufacturers should take full advantage of their present difficulties by regaining for themselves that proud and necessary enthusiasm and zest for business which they possessed in pre-war days. They should get busy on new and helpful stories that will fit and benefit to-day's conditions. Their interest in their products will return, their name will remain in the limelight, whilst at the same time they will be performing an interesting and useful national service. While they are helping their customers to solve their troubles they will be maintaining their good name and building for themselves a stronger friendship that will stand them in good stead when more normal times return, as assuredly they will.

Radio Relay Statistics.—It is reported that at September 30th, 1941, there were 343,593 subscribers to 279 radio relay exchanges, compared with 326,385 subscribers to 280 exchanges at June 30th, 1941, an increase of 17,208 subscribers.

Stone Masonry

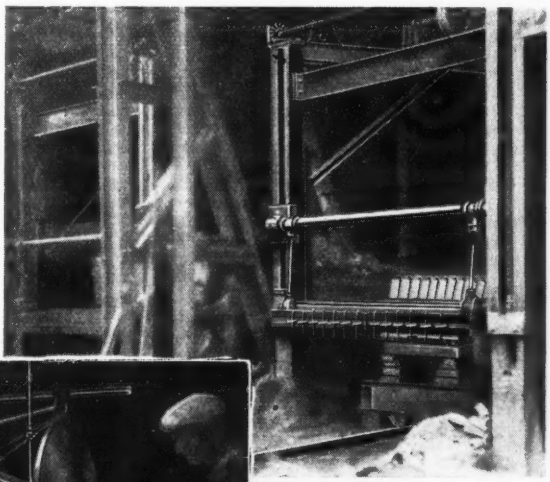
Modernisation of an Old-established Industry

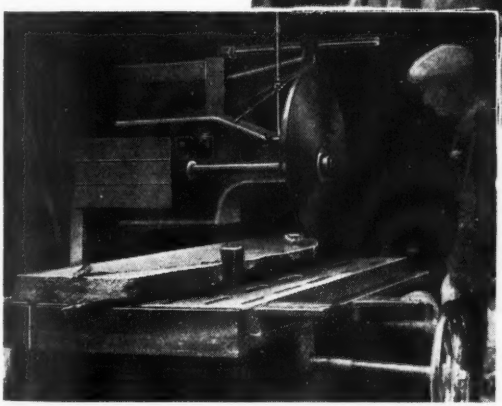
FOR over ten centuries the Royal Forest of Dean has been famous for its blue, grey and deep-red sandstones for architectural and monumental stonework, and the way in which this centuries old craftsmanship has adapted itself to modern methods, or should we say, has adopted modern methods to meet its own requirements, makes a fascinating story. At the works of the Forest of Dean Stone Firms, Ltd., the company which now quarries and prepares the stone, electrically operated apparatus has now been adopted for all except the most intricate processes, thereby eliminating an enormous amount of extremely arduous manual work. This extensive utilisation of electricity, incidentally, has only been made possible by the policy of the West Gloucestershire Power Co., Ltd., of encouraging rural industries.

The sandstone is brought from the neighbouring quarries in huge blocks which may weigh as much as ten tons. These blocks are hoisted into one of six swing saws, the largest of which is capable of making as many as twenty-four cuts at the same time through a stone 14 ft. long by 7 ft. thick. For the saws 5 in. or 6 in. by $\frac{1}{16}$ in. steel blades up to 16 ft. long, suspended horizontally, are employed, and they are fed with a mixture of grit sand and fine steel shot and water.

Two Crompton Parkinson motors of 20-HP each, running at 960 RPM, drive four of these saws in pairs. The other two saws are operated by a similar unit which also drives one of the planing machines which will be referred to later. The motors are connected by belting to countershafting and thence to pulleys on a flywheel crankshaft, where the rotary motion is converted, by means of spear rods attached between the flywheel crankshaft and the suspended saw frames, to the reciprocating motion needed. Belting also runs from the shafting to operate the water feeding device and ratchet systems.

Four inches an hour is considered a good average cutting speed, though of course this varies considerably in relation to the number and lengths of saw cuts being made. The



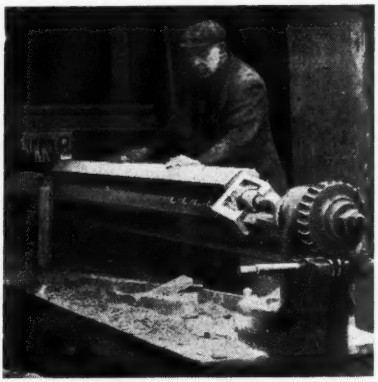


Two of the swing saws used for cutting up the large blocks of sandstone and (left) a carborundum circular saw which is of great value in saving masons' labour generally

speed of the saws is set according to the size of the frame and the saws are lowered automatically by means of a rachet system.

For making single cuts, for cutting odd pieces of stone, for small jobs, for taking out flutes

and checks, and for saving masons' labour generally, carborundum circular saws prove of great value, leaving only the finishing touches to be done by the mason's hand. Though they all have the same purpose, the four saws of this type installed differ slightly from each other. Two, each driven by a 20-HP, 960-RPM Crompton Parkinson motor, may be described as straightforward machines, while the third with a 30-HP motor, has been specially designed by the company to accommodate extra-large slabs of up to 8 ft. by 4 ft. All these units have 41 in. diameter blades.

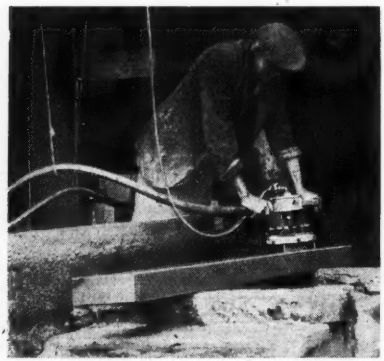


Taking off a chamfer by means of a planing machine

The fourth of these machines, incorporating a two-speed (725/1460 RPM) Hugh J. Scott & Co. 20-HP motor and having 27-in. blades, when fitted with grinding wheels, quickly removes bad surfaces and gives an almost polished face. It works on a cantilever so that it is possible to alter the pitch of the blade to take out checks or cut splays at any angle.

This machine, by the Anderson-Grice Co., Ltd., is fitted with an E.A.C. starter: in other instances Crompton Parkinson gear is employed.

If the circular saw fitted with grinding wheels is not used for smoothing the surface of the sawn slabs, planing machines, which are also useful for moulding, fluting, etc., are brought into service. There are three of these, two driven by a 15-HP, 720 RPM Lancashire Dynamo motor and the other through shafting by the 20-HP unit already referred to as driving two of the swing saws. For the final polishing process there are two polishing machines each driven by a ¾-HP motor comprising an 8 ft. flexible shaft and a head incorporating three carborundum bricks. One machine is by the Flextol Engineering Co., Ltd., and the other by the Flexible Drive & Tool Co., Ltd.



A final polish to the stone is given by this Flextol machine

We should like to thank the company for granting us permission to inspect its equipment, and also Mr. J. C. James, manager of the Bixslade Works, Park End, for the assistance which he afforded us in the preparation of this article.

The Modern Diesel

IN order to keep abreast of the rapid developments in heavy-oil-engine design six editions of "The Modern Diesel" have been called for in eleven years. Since the appearance of the first edition of this book in 1930, the compression-ignition engine has progressed from the earliest stage of development to its present outstanding position, high speeds have been attained and comparatively small units have become common.

In the present edition, pp. 238; illus., Iliffe & Sons, Ltd., Dorset House, Stamford Street, S.E.1; price 5s., which has been extensively revised, difficulties due to the war have not prevented the inclusion of much new and useful information, while the attention paid to maintenance problems, fuel injection (particularly direct-injection) systems and combustion-chamber design are once more notable features of the contents.

As the scope of the work is confined to prime movers for road and rail transport and aircraft and marine purposes, references to electricity are incidental only, *e.g.*, for starting and as a form of gearing, the latter helping the argument for the employment of Diesel locomotives as against steam.

The amount of information given in this book in proportion to its size is unusually high. Technical descriptions are given of the best-known makes of engines for various duties. The photographs have been well chosen to illustrate practical points and have been well arranged in proximity to the descriptive matter. Curves of performance also provide a ready guide to the capabilities of the several types of engine that are in use.

Skilled Men in the Forces

Committee's Report and War Office Reply

IN its first report the Committee on Skilled Men in the Services, presided over by Sir Wm. Beveridge, stated that the mechanical equipment of the Forces was being maintained with a notable economy of skilled men, and that vigorous efforts were being made to find suitable employment for qualified men in the Services, or those who could be trained to undertake skilled work. But still the need was not being fully met and a further substantial withdrawal of skilled men from civilian employment was considered necessary.

The Committee's second report seems to express somewhat modified views. Speaking generally, it seems that the Services (particularly the Army) are not making the best use of their skilled men. In support of this the results of interviews in 169 specific cases are tabulated, details being given in an appendix. Of these 139 were in the Army and it was found that 44 were employed in work suited to their qualifications (or about to be so employed); 20 were not fully occupied in such work; and the capabilities of 75 were not used at all.

The cases of 348 employees of two electrical engineering firms who had joined the Services, 268 being the Army, were specially investigated and it was found that while 78.1 per cent. of those in the Navy and 61.6 per cent. of those in the R.A.F. were engaged in responsible, skilled or semi-skilled engineering positions, only 44.2 per cent. of those in the Army were so engaged and, in fact, 43.9 per cent. were in posts which were neither engineering nor responsible.

A notable feature of 187 Army cases interviewed at their stations was the fact that only four out of 34 Royal Engineers were in suitable jobs. This is attributable to the fact that the establishments of the different operational units of this and other technical corps were fixed before the acute shortage of skilled engineers was realised. It is therefore recommended that these establishments shall be revised so as to release skilled men for large workshops such as those of the R.A.O.C.

Corps of Mechanical Engineers

It is considered that future enlistments should be into the Army, and not into a particular corps, to ensure greater freedom of movement of men to the most appropriate corps and that there should be established a Corps of Mechanical Engineers. The Navy's superior system is referred to and the Committee says that "until the Army gives to electrical and mechanical engineers, as distinct from civil engineers, their appropriate place and influence in the Army system, such engineers are not likely to be caught, tested and trained so well as in the Navy."

The conclusion is reached that, apart from the scarcity of armament artificers, there is a clear presumption that the unused reservoir of engineering skill in the Army is large and varied enough to meet all the requirements for men of engineering skill, and that until that presumption has been tested and disproved there is no case for withdrawing men from industry to meet those requirements. The needs of the Navy and R.A.F. are dealt with in Part II of the Report, which is not made public.

The Army's Views

The War Office does not agree with all that the Committee says, pointing out that the subject cannot be fitted entirely into the mould of civil industry, and it doubts whether the Committee could possibly have the fullest facts about the cases which they investigated, *e.g.*, some of the "unused" skilled men might have been earmarked for future skilled service in other units. It is suggested that the Committee has "failed to give due weight to the operational and maintenance commitments of an Army organised as an efficient fighting machine." A review of establishments is being undertaken with the aim of effecting economy in skilled man-power and during the last eight months much has been done to ensure that the numbers of units of operational requirements are no more than are absolutely necessary. The machinery for dealing with "misfit" tradesmen is being improved.

While the formation of the Corps of Mechanical Engineers is not considered an easy matter in the middle of a war, three senior members of the War Office staff, of high standing and long experience in the business world, are studying the proposal.

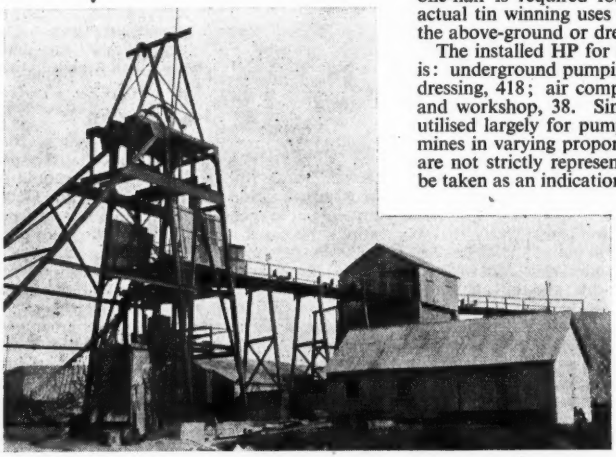
The Army would be glad to change the inherited system of enlistment for corps, but a radical and sweeping change would involve dislocation and legal difficulties. The matter has, however, been considered and the War Office has introduced an experimental system of intake for general service with a view to testing the possibilities and measuring the difficulties. If it is found practicable the War Office will introduce enlistment for the Army instead of for corps. In the meantime improved methods of selection and posting are being employed to Army intakes of men.

While recognising the value of the work performed by the Committee, the War Office reports that such a body must almost inevitably judge the matter according to civilian standards; in its memorandum the War Office has endeavoured to supply the necessary corrective from the military standpoint.

Tin Mining

Prospects of its Revival in Cornwall

WITH the loss to the Allied cause of the tin supplies of Malaya and the Netherlands East Indies, representing a very large proportion of the world's total production, the question arises as to the practicability and advisability of reviving the Cornish tin industry, which for many years has been allowed to decline so substantially. From the beginning of the century until about ten years ago an average of approximately 5,000 tons of tin a year was produced in Cornwall. Since then, however, there has been a steady decline until by 1940 the figure had fallen to only about 1,500 tons a year. Though this represents less than one per cent. of the world's total output, the yield from the Cornish ore is somewhat higher than that obtained from most other parts of the world.

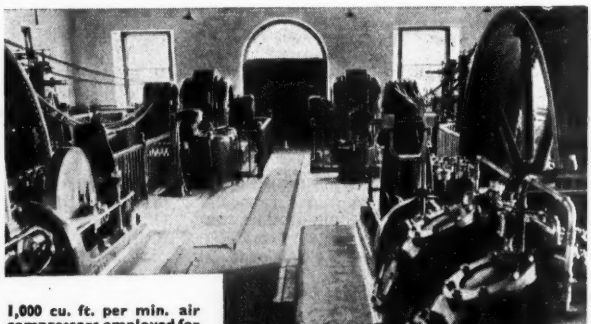


Headgear at a Cornish tin mine

At present there are, we believe, only four mines in operation in Cornwall. If the industry is to be revived to any extent it is to electricity that the producers must turn for assistance in rapidly increasing their output. In an up-to-date mine electrically operated plant is very much in evidence throughout every process and, to give an indication of the extent of its usage, one mine having an output of about 65,000 tons of crushed ore a year consumes about 2,000,000 kWh, of which approximately one-half is required for the underground or actual tin winning uses and the remainder for the above-ground or dressing plant.

The installed HP for the various operations is: underground pumping, 350; crushing and dressing, 418; air compressing, 765; sawmill and workshop, 38. Since, however, steam is utilised largely for pumping in this and other mines in varying proportions the figures given are not strictly representative and should not be taken as an indication of the possible extent of the use of electricity.

The air compressor plant which has been referred to, and which incidentally accounts for approximately two-thirds of the total maximum demand, is used principally for drilling the rock containing the tin-bearing lodes, but it is also employed to some extent for pumping, which, in view of the fact that in some mines the workings go out



1,000 cu. ft. per min. air compressors employed for drilling and pumping

under the sea for over a mile, presents something of a problem. In the dressing process, apart from the crushing, screening, conveying, elevating, etc., plant, magnetic separators are usually employed for removing the iron and wolfram.

From the electricity undertaking's point of view the tin mining load, though potentially a large one for the type of area served, cannot be said to be an ideal one, being even in normal times subject to the most violent fluctuations. In 1920 for instance, the Cornwall Electric Power Company, which supplies the whole of the tin-producing district, disposed of 17.9 million kWh to the mines, while in the following year they consumed only 4.8 million kWh. Similarly their consumption in 1927 was 19.7 million kWh, in 1931 2.2 million kWh, and in 1937 14.2 million kWh.

Whereas, however, the tin mine consumption in 1920 represented about 82 per cent. of the company's total output, in 1937, thanks mainly to the development of the domestic and business load and to a smaller extent to the establishment of other large power consumers, the percentage had fallen to about 38. Be that as it may, should it be considered desirable to reopen or extend the mines, the company can, we have no doubt, be relied upon to co-operate wholeheartedly and give any help in its power to provide the necessary electrical facilities.

INSTITUTION PROCEEDINGS

Safe Furnace Operation. *Spark Research.*

Electric Furnace Control

CONTROL and protective gear associated with electric furnaces of various kinds was the subject of a paper by Mr. W. Fordham Cooper (H.M. Electrical Inspector of Factories) presented to the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS in London on February 21st, the author being mainly concerned with precautions to minimise shock risks to which operators were exposed.

High-voltage contactors for motor-generators energising high-frequency induction furnaces must be so screened that they could not be touched. Medium voltage AC contactors mounted on racks for condensers correcting power factor must be allowed the full switchboard passageways required by No. 17 of the Home Office Electrical Regulations. To view them uninterruptedly when in operation there could be an expanded metal screen or glass panel in the door, which should be interlocked with the main isolator both mechanically and electrically, the latter alone being too easily rendered inoperative by injudicious electricians.

Breaks in Lining

For some time it did appear possible adequately to protect operators in the event of molten metal breaking through the refractory furnace lining, as it frequently did, so coming into contact with the surrounding inductor coils, consisting of hollow helices through which cooling water circulated. If two turns were thus short-circuited, the resulting arc would puncture them and a jet of water would be blown into the molten metal, causing violent ebullition of liquid steel, or an explosion. Penetration of water could now be largely guarded against as the result of research at one of the Sheffield steelworks by Messrs. Horsborough and Tetley, who had designed an earthed electrode for insertion into the bottom of the crucible, which became semi-conducting when warm so that leakage courrent could operate a sensitive relay before hot metal could penetrate to the embedded inductor coils; a recording milliameter in the relay circuit indicated the conditions of the furnace lining.

If the latter were a basic refractory, largely magnesia, it would tend to crack between melts so that penetration of liquid steel towards the water coils was more common than with silaceous acid linings. Both kinds of refractory were insulators when cool so that leakage relay protection was ineffective until the metal melted; therefore it did not obviate the necessity of creating an "earth free" area around the furnace.

Elaborate Precautions

The methods of arranging this could be quite elaborate; the working platform was usually of wood, but in one case of very large furnaces firebricks were bedded on two layers of timber, all metal control handles and hand rails near the furnaces being insulated; the control column for water cooling, etc., was placed at a distance and boxed in a wooden case; wooden kerbs had also been put round the bottoms of the control panels, even though they were 20 ft. away. Thus iron rakes and ladles lying on the floor could not cause fortuitous earthing within the working area by touching earthed metal at their far ends. Shocks had occurred in this way in recent years at the time of a hot metal break-through of the lining. For example, on one occasion the back wheels of a metal trolley used for carrying scrap were on some metal plates at a distance while the iron handle stretched forward sufficiently for the melter to tread on it when stepping back.

Static charges could be retained for considerable periods on power factor correcting condensers, if they were not provided with

discharging resistances. Also it was advisable so to interlock furnaces as to interrupt the power supply before they were tilted for teeming, which inevitably exposed some of the earthed steelwork of their crucible frames.

The main danger with arc furnaces was that operators might touch the carbon electrodes with a steel ladle, which was not very dangerous at 90V melting (50V to earth) but could be fatal with the 180 to 200V melting used to-day. It was virtually impossible to arrange any other protection than to make the operators wear wooden clogs.

Onerous Conditions

High-voltage furnace switches had to operate from 10,000 to 20,000 times a year, which was a duty no oil-immersed circuit-breaker had yet been designed to withstand. Consequently they suffered from pronounced mechanical troubles, aggravated by the high speed and inertia of modern solenoid actuation. Fatigue fracture, general loosening, flash-over and failure of dirty oil were typical faults. Oil should be changed at least once a fortnight (sometimes every week); at the same time contacts should be trued up, other parts tightened and insulators cleaned. It would normally be preferable to employ a simple switch with some of the ruggedness of a steel-mill contactor, backed up by a conventional oil breaker to deal only with short-circuits and for isolation. Oil switches should be substantially enclosed in 14-in. brick compartments with provision for pressure release, or 0.5-in. steel plates with all seams welded.

Control gear for heat treatment furnaces, usually of the resistance type, had many points of similarity with motor controllers. In addition to the main isolating switch and contactors, often push-button operated, the no-volt coil was generally interlocked with the furnace door to avoid the heating elements being touched when alive. Wiring and terminal blocks for automatic temperature control by balanced-bridge thermo-couples actuating contactors was not infrequently inextricably mixed up and insufficiently separated, as required by Regulation 14d concerning the general arrangement of switchboards.

Other Safeguards

Other items sometimes overlooked were the necessity of earthing switchboard lampholders on 200-V circuits and the provision of small fuses in subsidiary circuits for instruments and recorder motors, while the necessary guards over furnace time-switch terminals were frequently missing. Insufficient isolators were provided for sequence operation circuits, while panels were too often mounted side by side with inadequate spacing for safety in maintenance.

With regard to inert atmospheres within furnaces, the danger of leakage current arcing to earthed metal so as to ignite inflammable gas could be minimised by careful bonding of iron or copper tube; "compo" gas pipes should definitely be excluded, since leakage that was too small to blow a 5A fuse would puncture such a pipe and ignite the gas inside it.

The Electric Spark

THE new streamer theory of spark discharge, based on atom-physical considerations, which was dealt with in the paper by Mr. J. M. Meek (to which reference was made last week) stimulated discussion at the INSTITUTION OF ELECTRICAL ENGINEERS in London on February 19th.

Dr. T. E. Allibone (Metropolitan-Vickers Electrical Co.) said the theory had been expounded in great detail elsewhere and it was amazingly simple yet amazingly successful. It not only explained the actual breakdown voltage of sphere gaps, but also the many obtuse points of relatively small magnitude concerned with the problem. If the author had succeeded in doing nothing more than explain those many interesting, but important, points there was reason to feel indebted to him. Actually, he took the work much farther than mere explanation; great value of the paper was in the ideas it put forward for further research. As a result of what had been done DC spark-over would have to be studied afresh for it was now clear that it had been a mistake to deduce it in the way it had been done by B.S.I. and International Committees.

Effect of Electrode Materials

Greater precautions would also have to be taken with regard to the amount of ultra-violet light which the sphere gap could receive from an impulse generator. It would also be important to examine the effect of electrode materials, and he recalled that some ten years ago magnesium spheres were used which were not altogether successful. Did the author think the main reason for that was the nature of the oxide which was formed?

Dr. W. M. Thornton said that interest in the electric spark seemed to have fallen into two distinct lines: the short spark as used for petrol or gas engine ignition, and the long spark between sphere gaps for high-voltage insulation tests. Lightning was only an indirect concern of engineers, but photographs of lightning flashes were a guide to what occurred in artificially made long sparks. Townsend's formula was a direct outcome of the theory of ionisation by collision then being developed and it was still an adequate explanation of the mechanism of short sparks.

Of the various theories given to explain the long spark the most suggestive was Dr. L. B. Loeb's view that the spark when once well started was self-sustaining. Mr. Meek had put Dr. Loeb's qualitative theory into a formula based on the view that the discharge was self-sustaining when the sideways radial field due to

the positive ions liberated was equal to the longitudinal gradient. It was an interesting suggestion though not, by the nature of the case, a rigorous proof; but by using the best available experimental data connecting the formation of electrons with field strength and gas pressures, it was made to explain satisfactorily Paschen's law and the departures from it, and the breakdown strength of air in parallel gaps. He thought that even if parallel gaps did not entirely replace sphere gaps in practice they would be used to standardise them.

He mentioned examples of the rarely observed upward positive leader stroke from the ground in lightning discharge.

The results which he had hitherto regarded as the most convincing evidence of the electron avalanche theory of spark discharge were those of Dunnington. They showed that the condition of infinite conductivity did not occur simultaneously all along the path, as it should on Townsend's theory, but grew from one end. It was from evidence of this kind that the self-sustained discharge theory had probably been developed. Intense ultra-violet radiation from a Finsen iron arc with a high voltage alternating field and with a condenser across the gap should prove useful, since it could be used at much greater distances than the mercury arc lamp.

Mr. C. E. R. Bruce (Electrical Research Association) said that if one assumed that the radial field was 1/100th or even 1/1,000th of the applied field, instead of 1/10th, as the author had, the reduction in the spark-over voltage would be only 5 or 6 per cent. which, in view of the conditions, did not seem to be a very big drop. Certain aspects of work he had done on lightning discharges knocked on the head the re-combination theory which had been put forward elsewhere. The change from glow to arc conditions in lightning discharges suggested that a discharge from a point must start a glow, or brush, discharge and the leader stroke must finish as an arc discharge.

Radial or Axial Field?

Mr. G. W. Carter (B.T.H. Co.) expressed the view that the qualitative part of the paper was known before and, in his view, the quantitative results given in the paper deserved a little more credit than the author had given them. Personally he regarded the radial field as being the culprit in the breakdown because the axial field led to the formation of other avalanches. Considering the totally different assumptions underlying the new and classical theories, he was surprised there was no border-line region in which the characteristics of both had to be taken into account.

Dr. S. Whitehead (Electrical Research Association) said it was obvious that asymmetry would increase as the spaces of the gaps increased in relation to the diameter of the sphere. That could be allowed for by a factor which was quite calculable, the asymmetry depending on the sphere diameter. It was a function of the size of the sphere to the surrounding space. The asymmetry varied slightly with the diameter in the case of large spheres, but that limitation did not apply to small ones. For the positive impulse, however, that principle did not hold and different curves were obtained for different values of spacing. The author had given some of the reasons why the positive impulse values should not be related to the same extent. It could be taken, therefore, that the decreased voltage due to earthing one sphere was because the field was increased, and there was much evidence on that point.

Mr. E. G. Hill suggested that it was rather disturbing that there should be such a wide latitude, according to the theory, for he felt that the breakdown voltage was critical and he therefore wondered whether the theory had been fully substantiated. Again it was a pity the author had not considered the three-point gap, which was rather important, particularly in ignition work.

Author's Reply

The author, replying to the discussion, said it might well be, as Dr. Allibone had suggested, that the reason why the use of magnesium spheres had not been successful was because of the oxide layer formed on the spheres, and it was a point which required further investigation. One had to be careful in using copper or brass spheres because of the formation of an oxide layer, and copper had a particularly deleterious effect. It seemed to him very unlikely that humidity would influence the spark-over voltage in a uniform field, but it might affect the statistical time lag. Too much reliance should not be placed on quantitative agreement. Greater reliance should be placed on the fact that the theory explained a number of sparking phenomena in a qualitative manner. The fact that there was quantitative agreement was more or less fortuitous.

He did not wish to discuss glow to arc transition at the moment because the paper was mainly concerned with the initial formation of the streamer, or leader, stroke and breakdown in gaps in which corona was not observed to precede spark-over. However, the development of leader strokes was a subject on which he hoped to spend a considerable amount of further time, but he felt rather sceptical about the glow to arc transition occurring in the case of a lightning discharge when there was no metallic cathode.

Admittedly there was an axial field which would enhance the production of subsidiary electron avalanches, but the important fact was that the radial field caused the convergence of electron avalanches from all directions, and therefore he had stressed the radial rather more than the axial field. Asymmetrical sphere gaps had not been considered because the calculations were already sufficiently laborious. He hoped in the future, however, to consider the effect of the asymmetrical field for large gaps.

PERSONAL and SOCIAL

News of Men and Women of the Industry

FURTHER changes in the Government were announced at the beginning of the week. Among them was the appointment of Col. J. J. Llewellin as Minister of Aircraft Production and of Mr. Hugh Dalton as his successor at the Board of Trade. Mr. Dalton's place as Minister of Economic Warfare is taken by Lord Wolmer. Lord Portal becomes Minister of Works and Buildings and First Commissioner of Works in succession to Lord Reith. It had previously been announced that Lord Beaverbrook had resigned the post of Minister of Production on account of ill-health and that Col. Llewellin was to have general supervision of production as a member of the War Cabinet.

Flt.-Sgt. A. Stephenson, who has been a member of the Hull staff of the General Electric Co., Ltd., for ten years, has been awarded the D.F.M. for great devotion to duty. He joined the R.A.F.V.R. early in 1939.

The Council of the Institution has awarded the Faraday Medal to **Dr. P. Kapitza,** the eminent Russian scientist " for his notable contributions to science in the generation and utilisation of intense magnetic fields." Dr. Kapitza was born at Kronstadt in 1894, and studied at the Petrograd Polytechnic Institute (Faculty of Electrical Engineering).

Prof. P. Kapitza

After a period of lecturing at the Institute from 1919 to 1921, he was Clerk Maxwell Student at Cambridge University from 1923 to 1926, and was elected a fellow of Trinity College in 1925, and corresponding member to the Academy of Science of the U.S.S.R. in 1929.

In 1924 he was appointed assistant director of magnetic research at the Cavendish Laboratory, Cambridge, and the importance of his investigations was recognised by his appointment as Messel Professor of the Royal Society. On the opening of the Royal Society Mond Laboratory, Cambridge, in February, 1933, he was appointed director of that Laboratory, but later returned to Russia to carry on his investigations there. He is now director of the Institute for Physical Problems at the Academy of Science, Moscow.

Lieut.-General A. G. L. McNaughton, General Officer Commanding the Canadian Forces in Great Britain, has been elected an Honorary Member of the Institution of Electrical Engineers " in appreciation of the outstanding services rendered by him to promote the practical application of science to industry, in which respect his work on high-voltage research during his presidency of the Canadian National Research Council has been specially notable."

General McNaughton was born in Saskatchewan in 1887 and graduated at McGill University, where he was subsequently on the teaching staff and in private practice. In 1913 he became a major commanding a field battery in the Militia and during the last war served in France, being wounded at Ypres, the Somme, and at Soissons. Just before the end of the war he was G.O.C. Canadian Corps Heavy Artillery. On returning to Canada, he became successively Director of Military Training, Deputy Chief of the General Staff, and, in 1929, Chief of the General Staff, with the rank of major-general. In 1935 he became president of the Canadian National Research Council, a position which he still occupies.

Lieut.-Gen. A. G. L. McNaughton

He is well known for his work on the development of the cathode-ray direction-finder, in co-operation with Col. W. A. Steel. In the Research Council he promoted work on high-voltage investigations and not only equipped the laboratories for this purpose but took an active part in planning the experimental programme. In 1939 he was appointed by the Canadian Government as technical adviser to accompany a delegation of Canadian manufacturers to Great Britain in order to investigate the possibility of producing munitions in Canadian plants.

The retirement of **Mr. E. J. B. Greenwood,** superintending engineer, Pykara Electricity System, is recorded in the annual report of the Madras Government Electricity Department. He has been succeeded by **Sri T. J. Mirchandani,** whose former position of deputy chief engineer, for electricity has been filled by the promotion of **Sri Rao Sahib G. Yoganandam,** divisional electrical engineer, Trichinopoly.

Colonel S. J. Thompson, D.S.O., governing director of John Thompson, Ltd., has been elected president of the Institution of Mechanical Engineers, in succession to Mr. W. A. Stanier, chief mechanical engineer of the London, Midland and Scottish Railway.

At the meeting of Belfast Corporation Electricity Committee on February 19th, **Mr. W J. Girvan,** deputy city electrical engineer, was unanimously recommended for the appointment of city electrical engineer and manager in succession to **Mr. F. H. Whysall,** who is retiring at the end of March. Mr. Girvan joined the service of the Corporation in 1914, and at the age of only twenty-four he was advanced to the position of engineer in charge of the generating station, and in succession held the appointments of electrical superintendent, technical assistant, chief technical assi tant and consumers' engineer, taking over his present position in May, 1935. For some time he was a member of the teaching staff of Belfast College of Technology. He was the first secretary of the Northern Ireland Sub-Centre of the Institution of Electrical Engineers and is a past-president of the Belfast Association of Engineers. Mr. Girvan is a Belfast man by birth and the son

of a former official of the Corporation, the late Mr. Robert Girvan, who had been in the service of the Corporation for sixty-two years.

Mr. James Gray, chairman and managing director of the Electric Construction Co., Ltd., whose forthcoming retirement from the company was announced in our last issue, entered the services of Robert Addie & Sons, a prominent Scottish firm of iron & coalmasters, in 1877. There he obtained a thorough training in the commercial and clerical affairs of a large manufacturing undertaking. Later he became assistant accountant until 1888, when he was appointed to a similar position with C. de Murietta & Co., at that time an important firm of merchant bankers in London. There he had an insight into finance and all the features of a very large import and export house with connections in all parts of the world. In 1893 Mr. Gray was appointed secretary of the Electric Construction Co., Ltd. In 1901 he became managing director and in 1930 he assumed also the duties of chairman, which dual position he has continued to hold.

Mr. T. R. Edge, chief technical assistant in the Ipswich Corporation Electric Supply and Transport Departments, has retired at the age of sixty-seven, after thirty-six years' service with these undertakings. Mr. Edge, who received his early training with Callender's Cable & Construction Co., Ltd., after some service with the Doncaster Electricity Department, was appointed mains superintendent at Ipswich in 1906. During his tenure of office as chief technical assistant considerable development has taken place at Ipswich. In view of his extensive knowledge of the distribution system his services were retained, at the request of the Town Council, after he had reached the retiring age of sixty-five.

At a recent well attended meeting, representing all grades of the employees of the two undertakings, a presentation was made to Mr. Edge and many tributes were paid to his ability and kindliness.

Mr. G. Falk and **Mr. H. Falk** have been appointed joint managing directors of Falk, Stadelmann & Co., Ltd., in succession to the late Mr. L.Thurner.

Mr. H. Thompson, of the Birmingham branch of the Jackson Electric Stove Co., Ltd., who recently received a commission in the R.A.F., is now acting as Wing Catering Officer in a Northern Area.

Mr. D. W. Coates, chief accountant of the Central Electricity Board, has been appointed honorary financial adviser to the Petroleum Department.

Obituary

Mr. I. C. Thomas.—The death occurred on February 23rd of Mr. Ivor Cradock Thomas, M.V.O., O.B.E., M.I.E.E., who held positions with the Indian Government Telegraph Department from 1881 to 1916, being appointed Chief Engineer, Telegraphs, India, in 1913. From 1916 to 1919 he served with the Ministry of Munitions, Priority Department, Electrical Section, and from then until 1936 he was secretary of the Calcutta Electric Supply Corporation, Ltd. Mr. Thomas, who was a native of Llanelly, South Wales, was in his eighty-first year.

Mr. W. D. Stephen.—A prominent figure in Aberdeen's business life has been removed by the death, which occurred at Milltimber, at the age of fifty-nine, of Mr. William D. Stephen, managing director of Gray, Watt & Co., Ltd., wholesale electrical appliance factors. A native of Tarves, Mr. Stephen had been associated with the company for forty-two years and succeeded his father in the business, which is one of the oldest concerns in Aberdeen, having been founded in 1780.

M. Maurice Rambert, whose recent death in Geneva, at the age of seventy-five, is reported by the *Journal de Télecommunications*, was one of the founders of the Union Internationale de Radiodiffusion.

Correspondence

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Staffs and the Essential Work Order

THE overriding aim of the Essential Work Order is frequently side-tracked in the electricity supply industry. That aim is the fullest utilisation of the abilities of employees in order to obtain the maximum national effort, but we know of large employers who instead use it as a legal means to prevent disturbance of their own staffs.

In their memorandum upon transfers the Electricity Commissioners, by suggesting that the present employer's concurrence should be obtained *before* a vacancy is offered to an employee, enable these undertakings to present an overwhelming case for the retention of their own staffs without the matter ever securing impartial arbitration. Further, the Commissioners, when consulted, desire observations from both employers but not from the employee. He is often equally qualified professionally with both those desiring his services and therefore probably just as competent to comment on the fullest using of his abilities.

We are aware that appeal boards are in existence for arbitration, but how many employees from the grade of mains or charge engineer downwards would risk an appeal to that intricate machinery? One case was recently fought and was decided against the employee. It took four months.

Seldom does an employee secure advancement without increased responsibilities, and, generally, his move will be to a position of greater national importance. Furthermore, vacancies for mains and station superintendents, technical assistants, etc., are still advertised and, we assume, being filled. If these are secured by second or third and perhaps worse choices, it appears that the field from which future chiefs will be drawn is being narrowed sufficiently to cause concern to the whole industry.

London. THREE CHARTERED ENGINEERS.

Madras Plant Problem

Completion of Schemes Delayed

THE strategic position of India as a supply centre lends particular interest to a report recently received from the industrially important Presidency of Madras. In this, Lieut.-Col. M. G. Platts, Chief Engineer for Electricity, describes the year 1940-41 as having been an extremely difficult one for the Government Electricity Department.

One of the chief problems appears to have been the holding up of important construction schemes through delays in the delivery of plant. Manufacturing conditions in England were very difficult, and many important orders remained unfulfilled, he states. Fortunately reserves of power were available in the Pykara and Mettur systems, but in the Andhra and Papanasam areas extensions had to be restricted and load curtailed. Attempts were being made to meet the difficulties by obtaining heavy electrical plant from America wherever economically feasible.

The programme of works for 1941-42 included the Papanasam hydro-thermal scheme, on which an average labour force of 3,600 was employed during the past year; the installation of a fourth unit at Mettur, a third at Vizagapatam and a third at Bezwada; the West Godavari distribution scheme; the West Coast extension scheme; detailed investigation of the Machkand project; and the extension of Mettur supply to Madras.

Progress at Papanasam

At Papanasam progress on civil engineering works not dependent on imported materials was ahead of schedule. Last year was the third of construction and it is stated that if there were no further hitches in the delivery of the alternators and switchgear equipment these should be under erection during the first half of 1942. With regard to transformers the position was much better and the three 7,250-kVA units together with some of the indoor switchgear and other electrical equipment were delivered at the site between March and May, 1941. Owing to war risks the manufacturers had been instructed to ship equipment as it was ready, and it was satisfactory that these heavy and important items had arrived safely.

In connection with the Mettur installation, none of the generating equipment had been delivered at the date of the report and it was uncertain when it would be ready for shipment. Manufacture of the 1,500-kW set for the Andhra system, ordered in February, 1940, had been delayed for more than twelve months and the unit was not likely to be in operation before June, 1942. With regard to the 3,000-kW generating set for Bezwada it was expected that deliveries would enable this to be put into operation by about March, 1942. As the load situation had become acute there, arrangements were made to purchase surplus power from the Kistna Cement Factory.

Works to be carried out at Pykara cover supply extensions and system improvements. The new voltage regulators, exciters and certain special line protection relays for the outgoing 110-kV line, ordered about two years before for improving the rate of excitation response and the operation stability of the 7,810-kVA generators, had arrived at the site and were expected to be erected during 1941-42. An additional Ferranti 5,000-kVA, 110/66/22-11-kV transformer was expected to be received for installation at Coimbatore, where some of the lines operating at 11 kV were to be changed over to 22 kV to secure better regulation. Owing to the late arrival of transformers for Sembatti the 22-kV change-over of the Sembatti—Periyakulam—Bodinayakanur—Cumbum lines had to be deferred to 1941-42.

Another trouble experienced was that of breakdowns at Mettur, where the effects of the 1938 flooding continued to be felt. No. 1 generator broke down on two occasions and during the stormy weather in May, 1940, the two transformers at Tiruppattur substation were damaged owing to the failure of the protective gear to operate correctly under fault conditions. The high-voltage fuses at Vettavalam and Kaveripauk substations also failed to protect the transformers in service when faults occurred on the low-voltage side, and caused their breakdown.

The report shows that the aggregate of demand upon all the Government systems (inclusive of Papanasam which is under construction) during the year under review was 42,235 kW, against 38,350 kW in 1939-40, and the total number of kWh generated was 208.2 millions against 168.4 millions in the previous year.

Progress in the spread of electricity to rural parts was maintained, and Pykara power was extended to 27 villages and townships, making a total of 228 up to the end of March, 1941. In the Mettur system the number of villages and towns electrified rose from 80 to 128. In the Pykara system, the connected load of agricultural pump sets rose from 10,718 to 13,001 HP and in the Mettur system from 1,071 to 2,116 HP.

War Emergency Cable

IN order to economise in the use of rubber and by agreement with the Government, the Cable Makers' Association is producing, as from March 1st, a war emergency cable which will supersede the present standard C.M.A. grade and "Nonazo" class cable. Current ratings remain unaltered and the cable complies with latest issues of the Government Department electrical specifications. The cable will be sold under the standard C.M.A. label stamped with the words "War Emergency Cable" and the reference numbers applicable to C.M.A. grade cables will be used, prefixed by the letters "W.E."

To conserve cotton supplies C.M.A. members (whose names are given in an advertisement in this issue) will use existing stocks of printed tapes, but when these stocks are exhausted the war emergency cable will carry a tape bearing the name and address of the C.M.A. member, followed by the words "Member of the Cable Makers' Association." The cable will be available in all finishes in which C.M.A. grade cables have been available in the past. Revised net trade price lists are being issued by the Association this week.

The Government has also requested that as a means of reducing to a minimum the amount of rubber used in the cable industry, tough-rubber-sheathed cables and flexible cords should not be used where suitable alternative types are available.

COMMERCE and INDUSTRY

Building Control and Maintenance. Power Engineers' Claim

Rationing Difficulties

WHEN it was first proposed to ration electricity and gas it was pointed out to the Mines Department that it would be almost impossible to produce a workable scheme. After many hundreds of thousands of forms had been printed the Department decided that an appeal to the public to restrict consumption voluntarily was more likely to be effective. In response to proposals by the Select Committee on National Expenditure the Department mentions its collaboration with the gas and electricity industries to secure economy and says that difficulties of administration, including the question of enforcement " will be major considerations in connection with any scheme of fuel rationing."

Maintenance Work

Electrical maintenance work is included in the cost limit imposed by the Control of Building Order made by the Ministry of Works and Buildings. The Association of Supervising Electrical Engineers has pointed out that this may have the effect of unduly trimming maintenance, possibly with disastrous results. The Association emphasises that actually proper maintenance has the ultimate effect of limiting the use of materials and labour and suggests that if possible electrical maintenance and repair should be dealt with under a separate heading or licence. Another point put forward is that the enforced substitution of semi-skilled for skilled labour has increased costs and this should also be taken into account.

Lighting in Factories

Sir Duncan Wilson, who presided at a meeting in Birmingham last week convened by the National Industrial Electric Lighting Service, said that many employers and workmen were quite indifferent to the lighting conditions in their factories. Lighting, although as important a factor in industrial hygiene as ventilation and temperature, was often overlooked and neglected, especially in the Birmingham district. The Electric Lighting Service was prepared to give free advice to employers on the subject.

Mr. W. A. Bond, H.M. Inspector of Factories, spoke on the legal requirements and effects of lighting on safety in factories.

Conserving Tungsten Alloys

The Minister of Supply has issued the Control of Iron and Steel (No. 19) Order, 1942, which came into force on February 17th, and amends the No. 15 Order. The principal purpose of the Order is to conserve available supplies of tungsten alloys by restricting high-speed steel containing tungsten to purposes where its use is essential. The effect of the Order is as follows :—(1) High-speed steel, whatever the tungsten content can now only be acquired under the authority of a licence issued by the Iron and Steel Control. Hitherto a licence was necessary only when the tungsten content was 14 per cent. or more; (2) existing licences for high-speed steel containing 14 per cent. or more of tungsten will remain in force for steel of such specification until May 1st next. On and after that date such licences will automatically be valid only for high-speed steel containing up to 6½ per cent. of tungsten; (3) high-speed steel cannot now be acquired without licence from a stockholding merchant. Copies of the Order may be obtained from H.M. Stationery Office, York House, Kingsway, London, W.C.2., or through any bookseller.

Success of Warship Week

The result of the effort of the Brush Electrical Engineering Co., Ltd., in connection with Loughborough's Warship Week has exceeded the most optimistic expectations. Loughborough's aim was to raise £210,000 for the purchase of the Destroyer *Venomous*, and towards this the Brush Co. aimed to raise £1,200 for the purchase of the rivets required. Mr. A. P. Good, the managing director of the company informed employees on February 14th that the sum reached was £12,000. The company had promised at the beginning of the campaign that for every £1 invested by the employees during the period it would invest £2, and it had that day invested £25,000 making the total Brush contribution £37,000.

Rapid Car Enamelling

The provision of a new baked enamel finish on motor-cars, equal if not superior to the original, in less than half an hour is stated to be possible at the Sacramento works of Lester Motors, Ltd. According to *Electrical West* the paint is applied in the spray room in 15 min. and drying by infra-red lamps takes 12 to 15 min., varying slightly with the colour used. The drying room is totally enclosed and volatile vapours are removed through an exhaust duct. The oven consists of 350 240-W " Nalco Dritherm " lamps with aluminium reflectors mounted on channels. The channel units are made up into panel sections containing from 12 to 36 lamps.

Australian Electrical News

Our Perth (W.A.) Correspondent reports that while there has been a general increase in the use of electricity for cooking throughout the whole of the Sydney metropolitan area recently, the greatest development has been in hospital equipment, and a report from the sales branch of the Sydney County Council shows that the rating of connected cooking appliances in hospitals in Sydney exceeds 1,000 kW.

During the year ended June 30th, there were 120 electrical accidents reported in Queensland, eight of these being fatal. Ninety of the accidents occurred on consumers' premises while in twenty-four of the accidents employees of the electrical authorities were concerned.

Supplies of many electrical lines are short in all parts of the Commonwealth, stocks of cable and conduit being particularly low.

Among the electrical goods now to be approved by the authorities before being offered for sale in Queensland are electric razors, irons, soldering irons, portable immersion heaters, radiators,

toasters, jugs, grillers, hand-lamps, kettles, saucepans, wall switches, and bayonet-type lampholder adaptors.

A committee has been appointed by the Government of New South Wales to investigate the value of the Snowy River as a source of water supply for hydro-electric power. Members are as follows: Professor A. Miller, of the Sydney University; Mr. F. T. Farnsworth, chief engineer of the Metropolitan Water and Sewerage Board; Mr. F. H. Brewster, chief engineer of the Water Conservation and Irrigation Commission; Mr. G. W. Jones, engineer of the Water Supply, Public Works Department; and Mr. R. T. McKay, consulting engineer of Sydney.

Rubber Control

The Control of Rubber (No. 5) Order, 1942 (Stationery Office, 2d.) imposes restrictions upon the purchase and sale of waste rubber by reclaimers and fixes maximum prices for this material.

Practical Electrician's Pocket Book

The increasingly importance, under war conditions, of maintenance and repair is recognised in the 1942 edition of the " Practical Electrician's Pocket Book " by the inclusion of a new chapter on motor installation and maintenance which considerably extends the information previously given on this subject.

The contents of this publication are similar to those of previous editions, but there are a few small changes which aim at increasing its usefulness at the present time. For quicker reference, the detailed index has again been amplified and there further additions to the tabular reference data. The list of central station voltages has been revised. Of special topical interest is a new chapter on electrical devices for incendiary bomb detection. The chapter on kinema equipment has been re-written. The book is published by Odhams Press, Ltd., 92, Long Acre, W.C.2., at 3s., post free.

Supervisors' Annual Meeting

The Association of Supervising Electrical Engineers has decided to hold its annual meeting on May 18th in London. Motions for the agenda must be received by March 23rd, and nominations for the Executive Committee by April 27th.

E.A.W. Activities

At the seventh annual meeting of the London Branch of the Electrical Association for Women held recently the accounts were presented, showing a balance in hand. It was reported that £5 had been raised for the E.I.B.A. After a buffet lunch a paper on " Women's Part in Reconstruction " written by the chairman of the branch, Mrs. Leevers, was read by Mrs. Bentham. Miss Norvick presided.

Imports of Tanganyika

The total imports of electrical goods into Tanganyika in 1940 amounted in value to £35,900, compared with £40,300 in the preceding year. The principal items in 1940, with countries of origin and (where available) notes of increases or decreases compared with 1939, are shown below. It will be seen that Great Britain retained the major part of the trade. Cessation of building, development and settlement during the year, combined with the departure of former consumers, affected imports generally. At the same time import, as well as export, markets were to some degree stimulated by the preparations for the East African campaign.

	1940 £	Inc. or dec. on 1939 £
Accumulators and batteries—		
Total	8,400	*
From United Kingdom	4,900	
„ South Africa	600	
„ United States	2,400	
Cable and wire—		
Total	10,700	+ 3,400
From United Kingdom	10,100	+ 4,900
„ South Africa	600	+ 600
Dynamos, motors and rotary converters—		
Total	2,100	*
From United Kingdom	1,600	
„ United States	400	
Lighting bulbs and tubes for domestic lighting—		
Total	2,300	*
From United Kingdom	2,000	
„ Holland	200	
Bulbs and tubes for flashlights and handlamps—		
Total (mainly from U.K.)	130	*
Other lighting bulbs and tubes—		
Total (mainly from U.S.A.)	140	*
Electrical portable tools and appliances—		
Total (mainly from U.K.)	220	*
Telegraph and telephone instruments and apparatus—		
From United Kingdom	6,400	+ 3,900
Radio receiving sets—		
Total	3,900	− 4,800
From United Kingdom	1,700	− 2,400
„ United States	1,200	− 700
Other radio apparatus—		
Total	1,700	− 900
From United Kingdom	800	+ 200
„ United States	600	− 600
Other electrical machinery, goods and apparatus—		
Total	25,800	+ 8,200
From United Kingdom	24,000	+11,800
„ United States	700	+ 300
„ Switzerland	150	+ 150

* Comparative figures not available, owing to amplification of the classification in 1940.

Staff Men's Claim Fails

The National Arbitration Tribunal recently considered a claim by members of the Electrical Power Engineers' Association employed by the Grampian Electricity Supply Co. for the payment to them of rates of wages and the observance by the company of conditions of employment in accordance with the terms of joint agreements in the electricity supply industry.

Evidence was given regarding the rates and conditions agreed upon by the National Joint Board of Employers and Members of Staff, Electricity Supply Industry, and the employees' present terms and conditions. Mention was made of an offer by the company to the employees to continue their existing contracts of service or to terminate these and provide new contracts on the basis of the terms and conditions laid down by the National Joint Board. It was noted that these conditions did not include the provision of pensions and evidence was given of the extent to which superannuation or pensions schemes were operated by authorised electricity undertakings.

Subsequent to the hearing the two parties furnished to the Tribunal an agreed joint state-

ment showing the present salaries of the employees; the salaries which would be payable under the National Joint Board schedule; the benefits over and above salary at present enjoyed by the employees; and the benefits over and above salary which would be enjoyed under the N.J.B. agreements. Each party gave an estimate of the value of the various benefits.

In its award (No. 186, Stationery Office, 1d. net) the Tribunal says that after giving careful consideration to the statements and submissions made on behalf of the parties, it is not satisfied that the terms and conditions at present prevailing are less favourable than the terms and conditions provided by the agreements of the National Joint Board. It finds against the claim and awards accordingly.

Cinema Valves

There have been long negotiations between the Cinematograph Exhibitors' Association and the British Radio Valve Manufacturers' Association concerning the supply of valves required for use with amplifying equipment in picture theatres. Firm orders from cinema proprietors to cover requirements of amplifier valves for twelve months are now required by the B.R.V.M.A. Exhibitors who have service-maintenance contracts or other arrangements whereby replacements of valves are covered by agreement with an equipment firm, do not need to make any return. Only those theatres which purchase their own valves direct or through an accessory house are required to order immediately.

This direction applies only to valves required for sound amplification. Separate orders must be sent if valves supplied by more than one manufacturer are used in the theatre talkie set. It is pointed out that current rectification valves of the hot cathode type, will probably not be obtainable during the current year. Steps are being taken by cinematograph trade interests to obtain the necessary facilities for the manufacture of alternative types of rectifying apparatus.

Grossly Exaggerated

In last week's article on "Helping the Farmer," it was stated that the Shropshire, Worcestershire and Staffordshire Electric Power Co. had "succeeded in giving supplies to over 11,000 farms." The company points out that the correct figure is 1,100 and we regret our overstatement.

Wartime Regulations

One of the most difficult matters in wartime is to keep pace with the Orders and regulations issued in large numbers by all Government Departments, and we are not surprised that only two months after its publication the "Summary of the Emergency Statutes, Regulations and Orders affecting the Electricity Supply Industry" has had to be followed by a 48-page supplement. This deals with about sixty new measures and amendments made since the issue of the original summary and includes as well notes on a number of the matters then dealt with. For convenience of reference the numbering of pages is continued from the summary and the index is reprinted with the necessary additions. It is intended to employ this method in succeeding supplements.

As was stated in the review of the original publication, this useful guide has been compiled by Mr. Leslie Gordon (London J.E.A.) and Mr. J. W. Simpson (I.M.E.A.), assisted by Mr. F. Newey (Lincoln) and Mr. G. D. Helliwell (I.M.E.A.). The supplement (price 2s. 6d.) is obtainable from Mr. Simpson, Wellington House, 125–130, Strand, London, W.C.2.

New Catalogues and Lists

British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.—B.T.H. Lighting Bulletin No. 2: Service notes on the "Mazda" 80-W fluorescent lamp.

J. G. Statter & Co., Ltd., 82, Victoria Street, Westminster, London, S.W.1.—Publication No. 210, giving details relating to metalclad air-insulated drop-down draw-out switchgear for use on systems up to 11 kV.

Londex, Ltd., 207, Anerley Road, London, S.E.20.—List No. 97 illustrating and describing the company's synchronous time-delay relay, type "PRL," the various models of which cover a time range of from two seconds to 28 days.

S. O. Bowker, Ltd., Regent Row, Birmingham.—A wartime catalogue of "Tenby" electrical accessories.

English Electric Co., Ltd., Stafford.—Publication No. Q61A, superseding No. Q61, dealing with on-load tap-changing gear for large high-voltage transformers.

Change of Address

The Holborn works of Barimar, Ltd., suffered during a raid and the company's new address is Barimar House, Peterborough Road, Fulham, London, S.W.6.

Change of Name

B. J. Legg (Industries), Ltd., have changed their name to Legg (Industries), Ltd.

Calendar

The Modi & Modi Co., Bombay, has sent us a large wall calendar with monthly sheets.

TRADE MARK APPLICATIONS

AMONG recent applications for British trade marks are the following, objections to any of which may be entered within a month of February 18th:—

VIDA. No. 616167, Class 9. Electric flexibles, and wire and cables for electric transmission systems.—Jones, Stroud & Co., Ltd., Vidå Mills, New Street, Long Eaton.

SPEED-BIRD. No. 616185. Also design No. 616182. Both Class 9. Electrically operated indicating instruments and apparatus; scientific, nautical, surveying, wireless, photographic, signalling and life-saving instruments and apparatus; and fire-extinguishing apparatus; all for use in aircraft or launches.—British Overseas Airways Cpn., Grand Spa, Sion Hill, Clifton, Bristol.

CYCLOP. No. 617146, Class 11. Cycle lamps, electric lamps, and reflectors for lamps.—Egpertus Martinus Nicolaas Korving, trading as E. Korving, 11, Regent Street, London, S.W.1.

Sources of War Materials

Importance of Latin America

These notes deal with the sources of supply in Latin America, in threatened areas and elsewhere of some of the less-known minerals which may be of interest to the electrical industries. They are not intended to cover such major commodities as rubber, tin, copper and lead, with the position of which readers will be familiar. Regarding aluminium, it may be mentioned that Brazil has very large deposits of bauxite and is planning to utilise increasing quantities in her own works.

FOR several reasons Latin America has gained importance recently as a potential supplier of "strategic" materials. The Japanese advance in the Pacific threatens the supply of several at the source and of others through increased shipping difficulties.

For two or three years at least the United States authorities have been planning to increase their imports and reserves of such materials. In June, 1939, legislation for the purpose was passed and a programme has since been put into execution. Countries with which Washington has made agreements, generally covering the whole export surplus of the product required, include Brazil, Mexico, Peru, Bolivia, and Colombia, while the commodities which have been the subject of arrangements include rubber, tin, copper, zinc, lead, bauxite, chromite, mica, diamonds, tungsten, manganese, antimony and vanadium. Significance has been added to these arrangements by the Rio conference of Latin American States and the resultant declarations of unity with democracy's struggle against aggression.

Tungsten

China has been the leading producer of tungsten, but her trade has been hampered for several years by Japanese interference. Burma, the next largest producer, has also come within the field of enemy operations. The United States has for some time been developing its output of the metal, no doubt bearing in mind the shortage and consequent rise in price which occurred after the last war broke out. It has also been accumulating reserves.

In South America, Bolivia and Argentina are two promising producers, exports from the former being about equal to those of the United States. It is significant that imports into the United States increased in quantity ninefold between 1938 and 1939 and fourfold between 1939 and 1940.

About one-fifth of the platinum consumed in the United States goes to the electrical industry, for instruments, contacts, sparking plugs and similar requirements. In normal times about half has gone to the jewellery trades, the next largest outlet being the chemical industries which use it in the manufacture of acids and for lining vessels.

Canada is responsible for over one-third of the world production of platinum and over a half of that of the whole group of platinum metals. These include palladium, iridium, rhodium, ruthenium and osmium, which are for the most part employed for purposes similar to platinum. Colombia is the only South American country recorded as a producer of this group and has accounted for about 8 per cent. of the total. Another of the allies, namely the U.S.S.R., has promising resources which represent about a fifth of the world output. South Africa accounts for rather over 10 per cent.

Storage batteries and cables consume an appreciable part of the supply of antimony, which is used also in babbitt metal and in chemical manufacture. The United States has covered its needs mainly in Mexico and Bolivia. While exports from the latter have been increasing in recent years those available from China have been dwindling and are now probably below the level of either of the two South American countries named. Expert opinion holds that with an improving market Bolivian output might be raised to a "few times present production," provided the Government adopts a helpful attitude. Imports of antimony ore into the United States rose in value from $1,095,000 in 1938 to $2,027,000 in 1940.

Manganese

Manganese of special quality is used in making dry cells and in chemical, pottery and glass works, but the bulk goes to the steel manufacturer (who needs it for non-magnetic steel). Russia produces not far short of half the total world output, the latest statistics available showing a share of 2,273,000 tons out of 5,100,000 tons, while North America, including Cuba, and South America together account for approximately 300,000 tons.

The interest which the electrical industry has in cobalt lies in its use as an alloy in the manufacture of magnetic steel. Africa, notably the Belgian Congo, is by far the largest producer. In the Western Hemisphere Canada is the only exporter. Although in Burma there is a fair output of cobalt as a by-product of lead-zinc mining, in Mexico, where a large amount of lead and zinc is also mined, the recorded production of cobalt is very small. Deposits occur in Argentina, Chile and Peru.

Beryllium copper—a good conductor—is made in the United States, the beryl being

obtained from South America, notably Brazil, whose deposits are reported to be the largest in the world.

Extensive investigation has been made in the United States into possible sources of increased supplies of mercury, the consumption of which by the electrical industry has been growing steadily. Two-thirds of the imports into the United States have been derived from Spain which has been her chief supplier since Italy (who is the largest world producer) entered the war.

Mexico's contribution increased greatly in 1937 but fell away when relations with that country grew strained. Her output showed a large increase in 1940, *viz.*, to 402 tons, compared with 254 tons in 1939. With the resumption of former amicable trading relations with Mexico, there should be a fair prospect of making up any deficiency that might arise from interruption of shipping with Spain.

Cadmium, a by-product in zinc production, is used as an alloy of copper in the manufacture of cables, accumulator cells, and some other electrical material, and in fire prevention devices, including fuse wire. The United States is by far the largest producer and combined with Mexico accounts for more than half the total output.

The United States and Soviet Russia are the leading producers of mica, but India is the largest exporter, very notably of splittings. The mineral is found widely in Brazil. As during the last war, consumption has increased rapidly in spite of the adoption or incorporation of substitutes.

ELECTRICITY SUPPLY

Elgin Undertaking's Valuation. Protection at Dalmarnock.

Batley.—EXTENSIONS.—The Town Council is to carry out extensions to the electricity service at an estimated cost of £3,085.

Belfast.—RATE RELIEF.—The Electricity Committee has decided to make a grant of £11,000 towards the relief of the city rates "subject to the money being available."

Bolton.—COAL-HANDLING PLANT.—The Town Council is to apply for sanction to borrow for the installation of additional coal-handling plant, etc.

Bridgend.—PENYBONT COUNCIL'S PROTEST.—At a recent meeting of the Bridgend U.D.C. a letter was read from the Penybont R.D.C. in which dissatisfaction was expressed at the decision to retain the 12½ per cent. increase in electricity charges. It was submitted that through the guidance of Penybont Council Bridgend had been enabled to obtain substantial reductions in the price of its bulk supply. Penybont Council's assistance was given to enable Bridgend Council to give its customers the benefit of the reduction. After consideration it was decided to adhere to the previous decision.

Cheshire.—SHELTER HEATING.—The County Council has asked the county architect to obtain tenders for heating at Runcorn tunnel shelters.

Darlington.—GENERATING STATION ALTERATIONS.—Sanction has been received by the Town Council to borrow the additional amount required for work at the generating station.

Elgin.—VALUATION OF UNDERTAKING.—In November last the Elgin Electricity Supply Co., Ltd., applied to the Sheriff of Lothians and Peebles to have the company's undertaking valued by the assessor of public undertakings instead of by the Moray county lands valuation assessor. Objections were lodged by Elgin Town Council, as rating authority, and by the Joint County Council of Moray and Nairn, as valuation authority, and the application was debated in Edinburgh before Sheriff-Principal Brown, who has now sustained the contentions of the objectors that the application is irrelevant and that he has no jurisdiction.

Glasgow.—PROTECTION OF GENERATING PLANT.—The Electricity Committee is to have a completely new structure erected for the protection of the generating plant at Dalmarnock power station, designed to give effect to recommendations issued by the Electricity Commissioners.

Hamilton.—SUBSTATION.—Plans submitted for the erection of a substation have been approved by the local Dean of Guild Court.

Lichfield.—MAINS AND SERVICES.—The Electricity Committee is seeking sanction to a loan of £2,000 for mains and services.

Middlesbrough.—EXTENSIONS.—The Town Council is to spend £360 on extensions to low-voltage cables. Sanction has also been received to a loan of £897 for mains extensions, and application is being made to borrow £2,500 for mains, £2,000 for services and £500 for meters. The Electricity Commissioners have approved the charging of £985 for the purchase of transformers to the revenue account.

North Riding.—SCHOOL LIGHTING.—The Education Committee has agreed to proceed with the installation of electric lighting in five schools at a cost of £200.

Scarborough.—ROAD-OBSTRUCTION LIGHTING.—A 20 per cent. increase in electricity charges for the lighting of traffic islands, etc., has been approved by the Town Council.

Sheffield.—EXTENSIONS.—The Electricity Committee proposes to carry out extensions of the supply at a cost of £6,272.

Overseas

Sweden.—GOVERNMENT POWER SCHEMES.—In the Budget for the financial year 1942–43, the supply of electric power from the Government-owned water-power stations is likely to figure prominently. Owing to the present fuel situation, with difficulties in importing sufficient quantities of coal, the country's own power resources have become more important than ever, and the amounts included in the coming Budget, although not as big as during the past period of extensive power-station construction, are much

bigger than for the current financial year, *viz.*, Kr. 41,025,000 against Kr. 22,500,000. Work on the new Hojum station at Trollhättan will require a further Kr. 2,400,000 (making Kr. 18,900,000); the first unit has just been started, and the second set is expected to be completed this summer. For the Torpshammar station on the Gimän River a further Kr. 9,800,000 is required. The station, with two sets totalling 90,000 kW, is planned for completion by the end of 1943. Like many other Swedish water-power stations, it is constructed in the mountain side, impenetrable by bombs, but special measures must be taken to protect the above-ground parts. Kr. 12,000,000 is needed for work on the Midskogsforsen water-power station recently begun.

In conformity with a scheme recently submitted to the Government by the Waterfalls Board, a small power station will be constructed at Leringsforsen, on the Gimän River, to utilise certain water-power resources arising from regulation work on the Leringen and Holmsjoen Lakes, which are among the water reservoirs for the big Torpshammar station. For transmission extensions an allocation of Kr. 13,000,000 is proposed.—*Reuter's Trade Service.*

RADIO & TELEPHONY

Great Britain.—RADIO IN SMALL SHIPS.—The Admiralty has made the Wireless Telegraphy Apparatus and Watches (Small Vessels) Order, 1941, which directs that all British foreign-going ships of less than 1,600 gross registered tons (except passenger ships and warships) shall carry a radio-telegraph installation and at least one qualified operator. Transmission at 500 cycles on type A2 or B waves with a normal range of not less than 75 nautical miles is essential and the receiving equipment must be effective for all frequencies from 1,000 to 15 kc/s.

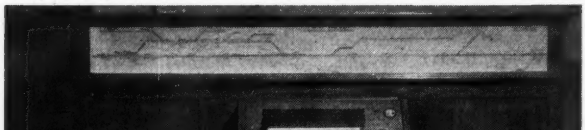
Switzerland.—TRANSFER OF LEAGUE TRANSMITTER.—The radio station set up some ten years ago by the League of Nations in conjunction with the Swjss radio system, at a cost of 4,200,000 Sw. fr., has passed entirely into the hands of Swiss radio. The transfer conditions have been fixed after arbitration by an international commission.

Save paper—and collect all waste

TRANSPORT

Darlington. — TROLLEY-BUS EXTENSION. — Subject to the approval of the Ministry of War Transport the Town Council is to proceed with a trolley-bus extension along Yarm Road.

L.N.E.R.—NEW TRAFFIC CONTROL OFFICE. — The original traffic control office for a district of the London & North Eastern Railway (Scottish area) was situated at Coatbridge, somewhat remote from the district superintendent's office, so it was decided to transfer the control and at the same time modernise and extend the facilities.



No. 1 sectional desk showing keyboard and diagram of lines controlled

The new office was opened on November 23rd last, and the area controlled extends practically over the whole district, including relative branches. The arrangements now comprise new tables with keyboards giving access to three new direct selective circuits connecting selective way-stations, together with selective apparatus operating over trunk lines connecting control circuits and local circuits operating direct from the keyboards by ordinary code ringing. Previously manual exchanges were connected by trunk lines to the old control office at Coatbridge, but these have now been closed and the trunk lines extended through to the new office.

The contractors responsible for the supply of all new tables, keyboards, selective apparatus and telephones, together with the control room wiring, were Standard Telephones & Cables, Ltd. The outside line construction work, cabling and way-station installations were carried out by the Railway Company's signal and telegraph staff. The scheme was prepared to meet the requirements of the superintendent, L.N.E.R. (Scottish area), the work being carried out to the instructions of the area engineer, and under the immediate supervision of the area signal and telegraph engineer and his staff.

Arc Welding Equipment

THE revision of B.S.638 for electric arc welding equipment and welding accessories, which was first issued in 1935, shows that a somewhat lighter and more flexible type of cable has now been specified. Provision has been made for DC and AC reactors and requirements have been included relating to voltage regulation for both welding generators and transformers. An appendix which has been added sets out in detail the information to be included on the rating plates for each type of equipment. Other alterations relate to some of the temperature rises, the maximum voltage recommended, values of the rating current, etc. Copies of this specification may be obtained from the British Standards Institution, 28, Victoria Street, Westminster, S.W.1, price 2s. 3d. post free.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The English Electric Co., Ltd., held its annual meeting on February 18th, when Mr. G. H. Nelson (chairman and managing director), who presided, said that in addition to the £100,000 they had added to the reserve, there was under the last Finance Act a blocked reserve in their E.P.T. payments. Vague and indeterminate as the Act was on this subject, it must be read in the light of the Chancellor's Budget speech, in which the intention of the Government to provide in this way some alleviation of the post-war burdens of industries such as theirs was made clear.

The directors believed that it would be in the national interest for Parliament to translate the Chancellor's explicit statement, at an early date, into equally explicit legislation and so to place it beyond any doubt that companies which had devoted themselves without stint to the war effort would not, by the necessary severity of war taxation, be unreasonably hampered in their post-war effort to provide stability of employment for their own staff and workpeople.

Their works were fully occupied and they had received expressions of appreciation of what they were doing and of the reliability of their promises. They recognised that the world, after peace, would have many problems, that no great manufacturing organisation would be immune from them and that no one else could solve them. With a loyal and efficient team of technical staff and skilled workers, with a strong financial position and high reputation, they looked with confidence to playing a worthy part in the work of reconstruction, both at home and abroad, after the war.

Mr. Nelson referred to the frequent over-publicity given to views expressed, or allegations made, by people who were not qualified to judge, on inefficient production. He said that this was a factor very disturbing to the national effort, for although there would always be some inefficient and bad elements in all walks of life, they were a minority and their importance should not be exaggerated.

The Southern Railway Co. reports a net revenue for 1941 of £6,934,260, an increase of £178,470 as compared with the preceding year, which with £91,930 brought in, makes £7,026,190. It is proposed to pay a final dividend on the preferred ordinary stock of 2½ per cent., making 5 per cent. for the year (same) and 1¾ per cent. for the year on the deferred stock (against 1¼ per cent.). The balance carried forward is £101,336.

The London Passenger Transport Board announces that under the revised railway control agreement the fixed annual payment is £4,835,705. The net revenue of the Board for 1941, after giving effect to pooling arrangements, together with a profit on the realisation of investments and the balance of the London Transport "C" stock interest fund, amounts to £4,844,659 (against £4,853,236). Interest on the prior charge stocks requires £4,080,447. The balance for the service of the "C" stock is £764,212, a decrease of £8,577. The final payment on the "C" stock is 2¼ per cent., less tax, making 2⅞ per cent. for the year. The £25,371 remaining, being less than one-eighth of 1 per cent. on "C" stock outstanding, has been transferred to the "C" stock interest fund. The balance a year ago was £1,825.

The Dublin United Transport Co., Ltd., reports a net revenue for 1941 of £225,972, as compared with £102,292 for 1940. Tax requires £160,000 and pensions £25,000. As already announced, the final ordinary dividend is 3 per cent., making 5 per cent. for the year (against 4 per cent.), and £23,533 is carried forward (against £21,561 brought in).

The County of London Electric Supply Co., Ltd., proposes to pay a final dividend on the ordinary stock of 5 per cent., maintaining the dividend for the year at 8 per cent.

The City of London Electric Lighting Co. Ltd., has declared a final dividend of 4 per cent., again making 7 per cent. for the year.

The Clyde Valley Electrical Power Co. is maintaining its dividend at 8 per cent. by a final distribution of 5 per cent.

The Electrical Distribution of Yorkshire, Ltd., is again paying a final dividend of 4½ per cent., making 9 per cent. for the past year.

Taylor, Tunnicliff (Electrical Industries), Ltd. is again paying a final dividend of 10 per cent., maintaining the total for the year at 12½ per cent.

The Hoffman Manufacturing Co., Ltd., is paying a final tax-free dividend of 10 per cent., again making 17½ per cent., free of tax, for the year. The net profit was £220,452, against £250,941.

Clarke, Chapman & Co., Ltd., have announced a first and final dividend of 12 per cent. (against 12½ per cent.).

New Companies

Major Battery Components, Ltd.—Private company. Registered February 11th. Capital, £1,000. Objects: To carry on the business of manufacturers, salvors and wholesalers of, and dealers in, electrical appliances, dry batteries and components, mechanical, radio, electrical and general engineers, etc. Subscribers: O. Fleming, 131, Regent Street, W.1, and Miss Ruth Dettinger, 63, Canfield Gardens, N.W.6. Registered office: Westmorland House, 131, Regent Street, W.1.

Electro Precision Gauge Co., Ltd.—Private company. Registered February 3rd. Capital £1,000. Objects: To carry on the business of gauge and tool makers, electrical, motor and mechanical engineers, etc. Directors: W. Wild and Lilian M. Wild, both of The White House, Chapel Lane, Hockley Heath, Warwickshire, and J. Marshall, 198, Widney Manor Road, Solihull, Warwickshire. Secretary: Lilian M. Wild.

Barnes Appliances, Ltd.—Private company. Registered February 9th. Capital £100. Objects: To carry on the business of electrical engineers and contractors, manufacturers of and dealers in electro-medical, surgical, hospital, anatomical, hygienic and scientific appliances and

instruments, etc. Directors: A. H. Munslow, 42, Hibbert Street, S.W.11, and H. G. Munslow, 51, Clonmore Street, S.W.18. Registered office: 1, Ranelagh Gardens, Barnes, S.W.13.

Charles Harmer & Sons, Ltd.—Private company. Registered February 11th. Capital, £500. Objects: To carry on the business of manufacturers of, and dealers in, X-ray, violet and other ray, scientific and curative apparatus, nautical, optical and other instruments, etc. Directors: C. Harmer and A. J. Harmer, both of 64, Tetherdown, Muswell Hill, N.10, C. T. Harmer, 28, Bush Hill Road, N.21, and F. Harmer, 2, West Way, Deans Lane, Edgware. Registered office: 29, Danbury Street, N.1.

Janco Engineering Co., Ltd.—Private company. Registered February 9th. Capital, £200. Objects: To carry on the business of mechanical and electrical engineers, tool makers, wire-drawers, metal workers, tube makers, iron and brass founders, electro and chromium platers, etc. Directors: J. P. Johnson, St. Gerard's, Warwick Road, Solihull, Warwicks, and C. E. Anderson, 391, Station Road, Dorridge, Warwicks.

Precision Resisters, Ltd.—Private company. Registered February 11th. Capital, £500. Objects: To carry on the business of electrical and mechanical engineers, manufacturers of and dealers in electrical, radio, telephone, telegraph and scientific instruments and appliances, etc. Directors: S. C. Slaughtern, 10, Eaton Road, Sutton, Surrey, and S. A. Letts, C.A., 21, Revell Road, Cheam.

N. W. Harrap, Ltd.—Private company. Registered February 14th. Capital, £100. Objects: To carry on the business of mechanical and electrical engineers, founders and fitters, tool makers, metal workers, etc. Subscribers: N. W. Harrap and Mrs. Jean D. Lockett, both of 21, Hilton Crescent, Prestwich, Lancs. Registered office: Deansgate Arcade, Deansgate, Manchester.

Locke & Soares (1942), Ltd.—Private company. Registered February 16th. Capital, £5,000. Objects: To carry on the business of manufacturers of, and dealers in, dynamos, motors, armatures, magnetos, batteries, insulators, electrical plant and supplies, etc. Directors: A. J. Rowden, S. Rann and F. Walbery. Registered office: 261, Lavender Hill, S.W.11.

Companies' Returns

Statements of Capital

British Columbia Electric Railway Co., Ltd.—Capital, £6,320,000 in £1,440,000 5 per cent. cumulative perpetual preference stock, £1,440,000 preferred ordinary stock, £2,406,103 deferred ordinary stock and 1,033,897 shares unissued. Return dated October 6th. £1,440,000 5 per cent. preference stock, £1,440,000 preferred ordinary stock and 2,406,103 deferred ordinary stock taken up. £5,286,104 15s. paid. £1 15s. paid on seven shares forfeited. Mortgages and charges: £2,788,170.

Thorn Electrical Industries, Ltd.—Capital, £150,000 in 400,000 ordinary shares of 5s. each and 50,000 preference shares of £1. Return dated September 22nd. All shares taken up. £63,150 paid on 52,600 ordinary and 50,000 preference shares. £86,850 considered as paid on 347,400 ordinary shares. Mortgages and charges: Nil.

National Accumulator Co., Ltd.—Capital, £350,000 in 175,000 preferred ordinary and 175,000 deferred ordinary shares of £1. Return dated June 17th (filed July 4th). All shares taken up. £292,616 paid. £57,384 considered as paid. Mortgages and charges: Nil.

Jewel Battery Co., Ltd.—Capital, £5,000 in 2,500 preference and 2,500 ordinary shares of £1. Return dated October 21st. 2,000 preference and 600 ordinary shares taken up. £2,600 paid. Mortgages and charges: Nil.

Adamson, Green & Co., Ltd.—Capital, £5,000 in £1 shares. Return dated September 22nd. 900 shares taken up. £900 paid. Mortgages and charges: Nil.

Pertrix, Ltd.—Capital, £10,000 in £1 shares. Return dated August 4th. All shares taken up. £10,000 paid. Mortgages and charges: Nil.

Air Ducts, Ltd.—Capital, £10,000 in £1 shares. Return dated October 30th. 9,503 shares taken up. £9,503 paid. Mortgages and charges: £56,122.

Mortgages and Charges

Star Electrical Co., Ltd.—Satisfaction to the extent of £1,100 on January 23rd, 1942, of debentures registered December 29th, 1933. (According to the register of mortgages the debentures registered December 29th, 1933, originally secured sums not exceeding £1,250).

T. N. J. Electrical Engineering Co., Ltd.—Debenture, dated January 10th, 1942, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: N. Weseler, 217, Beehive Lane, Ilford.

Electro-Generators, Ltd.—Particulars filed of £1,500 debentures authorised January 22nd, 1942, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Laypak Battery Co., Ltd.—Satisfaction in full on August 25th, 1941, of debentures authorised November 25th, 1932, and registered same date, securing sums not exceeding £5,000.

Underwood (Electric), Ltd.—Assignment of contract moneys, dated February 5th, 1942, to secure all moneys due or to become due from the company to Martins Bank, Ltd., not exceeding £2,700.

F. Fradley, Ltd.—Charge on contract moneys, dated February 27th, 1942, to secure all moneys due or to become due from the company to National Provincial Bank, Ltd.

Hume Atkins & Co., Ltd.—Issue on February 10th, 1942, of £200 debentures, part of a series already registered.

Liquidation

Jarvis Bros., Ltd.—Particulars of claims by April 30th to the liquidator, Mr. J. H. Tate, Royal Exchange, Middlesbrough. A declaration of solvency has been made and all creditors have been or will be paid in full.

Bankruptcy

J. H. Matthews, electrical dealer, 232, Town Street, Bramley, near Leeds.—Last day for receiving proofs for dividend March 7th. Trustee, Mr. H. C. Bowling, 24, Bond Street, Leeds, Official Receiver.

STOCKS AND SHARES

TUESDAY EVENING.

THE Home Railway dividend declarations did little to expand the volume of business in the market for the stocks. With the exception of the Great Western and the London Passenger Transport Board, all the announcements were satisfactory from the point of view of the stockholders. The market, nevertheless, went dull, failing to attract public attention sufficient to counteract profit-taking by previous bulls.

Gilt-edged stocks keep firm, in advance of the release of the money that will be paid in respect of the vested India and Canadian stocks: the first payment starts on March 2nd with the India stocks. Cable and Wireless stocks have given way sharply, on account of the Japanese activity in the Far East. Industrials are less buoyant. Sales are predominating on behalf, no doubt, of people who require money for Warship Weeks, taxation, living expenses and other calls upon their capital.

During the current month some 200 cities, towns and villages arranged their Warship Weeks. Money which might otherwise purchase stocks and shares in the House, is directed into the Government loans. The result is seen in a slight weakening of the industrial shares which, for several months past, have been conspicuous by their firmness. Electricity supply shares hold their ground in most cases. County of London & London Associated Electrics have gone back a trifle, but a 1s. rise took Llanelly ordinary to 23s.

Railway Results

London Passenger Transport Board has cut its dividend on the "C" stock by ½ per cent., the distribution for the year being 2⅜ per cent. This came as a distinct disappointment to the optimists, who were going for an increase rather than a decline. The price of the "C" stock is nominally unchanged at 39 ex dividend. The prior charge stocks have moved hardly at all. The Southern Railway has increased the dividend on its deferred stock, but this did not prevent a fall of a point in the preferred. Thomas Tilling went back ½ to 46s. 3d. on the Transport Board's announcement: the company is a large holder of the "C" and other stocks.

Manufacturing and Equipment

Some of the equipment and manufacturing favourites have receded. British Insulated at 91s. 3d. are down ½; Johnson & Phillips at 58s. 9d. show a loss of 9d.; and Murex at 90s. have fallen 5s. Callender's are easier at 72s. 6d., Ever Readys at 31s. On the other hand, Consolidated Signal shares regained their dividend deduction, and remain at 77s. 6d. Bristol Trams have advanced to 45s. ex dividend, the rise in dividend from 8 per cent. to 10 per cent. bringing in buyers. The report of the company, which has abandoned tramways in favour of omnibuses, shows excellent figures. Bristol Tramways is controlled indirectly by the Great Western Railway and the National Omnibus Company.

Overseas Shares

Indian industrials are mostly lower. Calcutta Electrics at 26s. 3d. are 5s. down, the preference are easier at 22s. 6d. Calcutta Trams at 17s. 6d., the preference at 16s. 3d., and Cawnpore Electric at 28s. 9d. are 1/16 down, while Madras Electric at 18s. 9d. have lost half-a-crown. The uncertainty with regard to the distribution of profits on Australian companies led to a further drop in Kalgoorlie Electric to 9s. 6d. Victoria Falls show a loss of 6s. 3d. at 71s. 3d. Perak Hydro-Electrics are 1/16 weaker at 6s. 3d. and the Canadian utilities have given way to a modest extent.

English Electric

The chairman of the English Electric Company at the annual meeting brought forward a point of considerable interest to shareholders in many other companies besides his own. He said that in addition to the £100,000 which the company has added to its reserve, there was, under the last Finance Act, a blocked reserve in the company's E.P.T. payments. The Chancellor's Budget speech made it clear that the Government's intention was to provide in this way some alleviation of the post-war burdens of industries such as theirs. The directors of the English Electric Co. believed that it would be in the national interest for Parliament to translate the Chancellor's explicit statement at an early date into equally explicit legislation. This would place it beyond any doubt that companies which had devoted themselves without stint to the war effort would not be unreasonably hampered by war taxation in their post-war effort to provide stability of employment for their workpeople.

In proposing the payment of a 10 per cent. dividend, he referred to the many thousands of their shareholders who depended upon the dividend as an essential part of their income. "As shareholders are not fortunate enough to receive war bonuses on their investments, we feel," he added, "they should receive as generous a dividend as prudence will allow." At 38s. 9d., the price is unchanged: the yield on a 10 per cent. dividend basis, is £5 3s. per cent.

Cable and Wireless Relapse

The principal movements in prices this week are the falls in Cable and Wireless ordinary and preference: the ordinary has fallen 7½ and the preference 8. These came on top of previous declines, and prices now have reached levels at which speculative investment begins to take practical interest. The fall has been brought

(*Concluded on page* 289)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Feb. 23	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	15	12½	55/-	..	4 11 0
British Power and Light	7	6	27/6	..	4 7 3
City of London ..	7½	7	27/-	..	5 3 9
Clyde Valley ..	8	8	38/9	..	4 2 0
County of London ..	10½	8	37/6	—9d.	4 5 6
Edmundson's:					
7% Pref. ..	7	7	33/3	..	4 4 4
Ord.	6	6	28/6	..	4 4 3
Elec. Dis. Yorkshire	9	9	42/6	..	4 4 9
Elec. Fin. and Securities	12½	12½	45/-	..	5 11 2
Elec. Supply Corporation ..	11½	10	45/-	..	4 9 0
Isle of Thanet ..	2	Nil	9/-	..	—
Lancs Light and Power	7½	7½	34/6	..	4 7 0
Llanelly Elec. ..	5½	5½	23/-	+1/-	4 15 8
Lond. Assoc. Electric	5½	4½	18/9	—9d.	4 16 0
London Electric ..	7	7	24/6	..	5 14 3
London Power Deb. Red.	5	5	105	..	4 15 3
Metropolitan ..	10	8	37/-	—6d.	4 6 6
Midland Counties ..	8	8	38/9	..	4 2 0
Mid. Elec. Power ..	9	9	41/3	..	4 7 4
Newcastle Elec. ..	7	7	27/6	..	5 1 10
North Eastern Elec.:					
Ordinary ..	7	7	30/9	..	4 11 1
7% Pref. ..	7	7	34/-	..	4 2 4
Northampton ..	10	10	46/3xd	+6d.	4 6 7
Notting Hill 6% Pref. (£10) ..	6	6	8½	..	—
Northmet Power:					
Ordinary ..	10	7	35/9	..	3 18 4
6% Pref. ..	6	6	31/-	..	3 17 5
Richmond Elec. ..	6	6	23/9	..	5 1 1
Scottish Power ..	8	8	38/9	..	4 2 9
Southern Areas ..	5	5	19/6	..	5 2 8
South London ..	7	7	25/-	..	5 12 0
West Devon ..	5	5	21/3	..	4 14 1
West Glos. ..	4½	4½	21/3	..	4 4 8
Yorkshire Elec. ..	8	8	39/6	..	4 1 0
Overseas Electricity Companies					
Atlas Elec. ..	Nil	Nil	4/3	—3d.	—
Calcutta Elec. ..	8*	7*	26/3	—½	—
Cawnpore Elec. ..	10	10	28/9	—⅛	6 19 4
East African Power	7	7	27/-	..	5 3 8
Jerusalem Elec. ..	7	5	18/9	..	5 6 8
Kalgoorlie (10/-) ..	7½	7½	9/6	—1/-	7 12 10
Madras Elec. ..	6*	4*	18/9	—¼	4 5 4
Montreal Power ..	1½	1½	23½	—½	6 5 0
Palestine Elec. "A"	Nil	Nil	20/9	..	—
Perak Hydro-elec. ..	6	7	6/3	—⅛	22 8 0
Shawinigan Power	83cts.	90cts.	14½	..	—
Tokyo Elec. 6% ..	6	6	12½	..	—
Victoria Falls Power	15	15	71/3	—⅛	4 4 3
Whitehall Inv. Pref.	7½	7½	15/-	..	10 0 0

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Feb. 23	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1950-70	5	5	110	..	4 11 1
1955-75	5	5	115	..	4 7 0
1951-73	4½	4½	109	+1	4 2 7
1963-93	3½	3½	103	..	3 8 0
1974-94	3½	3½	99	..	3 5 8
London Elec. Trans. Ltd.	2½	2½	94	—1	2 13 2
London & Home Counties 1955-75	4½	4½	109	..	4 2 7
Lond. Pass. Trans.:					
A	4½	4½	119½	..	3 15 4
B	5	5	119½	..	4 3 8
C	3	2⅞	39xd	..	7 7 5
West Midlands J.E.A. 1948-68 ..	5	5	110	..	4 11 0
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	107½	—1	5 11 8
Def.	1½	1½	24½	—1	6 2 5
Anglo-Portuguese	8	8	15/-	..	10 13 4
Cable & Wireless:					
5½ Pref. ..	5½	5½	96½	—8	5 14 0
Ord.	4	4	58½	—7½	6 16 9
Canadian Marconi $1	Nil	4cts.	5/6	..	3 0 0
Globe Tel. & Tel.:					
Ord.	8½*	8½*	30/-	..	—
Pref.	6	6	28/9	..	4 3 4
Great Northern Tel.: (£10)	20	20	14½	..	—
Inter Tel. & Tel. ..	Nil	Nil	3	..	—
Marconi-Marine ..	7½	7½	28/9	..	5 4 4
Oriental Tel. Ord. ..	11½*	16	52/6	—½	6 2 9
Telephone Props. ..	6	6	10/-	..	12 0 0
Tele. Rentals (5/-)	10	10	9/-	..	5 11 1
Traction and Transport					
Anglo. Arg. Trans.:					
First Pref. (£5) ..	Nil	Nil	5/-	..	—
4% Inc.	Nil	Nil	9½	+1	—
Brit. Elec. Traction:					
Def. Ord. ..	45	45	915	—10	4 18 3
Pref. Ord. ..	8	8	170	..	4 14 2
Bristol Trams ..	8	10	45/-xd	+1/3	4 9 0
Brazil Traction ..	$1	50c.	12⅞	—¼	—
Calcutta Trams ..	8	5½	17/6xd	—1/3	6 5 8
Cape Elec. Trams ..	5	5	18/6	..	5 8 3
Lancs Transport ..	10	10	45/-	..	4 9 0
Mexican Light:					
1st Bonds ..	5	5	77½	—2½	6 9 0
Rio 5% Bonds ..	5	5	96½	+1	5 3 8
Southern Rly.:					
5% Prefd. ..	5	5	63½xd	—1	7 17 6
5% Pref. ..	5	5	107½	..	4 13 0
T. Tilling ..	10	10	46/3xd	—1/8	4 6 9
Tilling & B.A. ..	7*	6½*	52/6	..	2 9 6
West Riding ..	10	10	40/-	..	5 0 0

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Feb. 23	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord. ..	Nil	7½	23/–	..	6 10 4
Assoc. Elec.:					
Ord.	10	10	46/3	..	4 6 9
Pref.	8	8	38/9	..	4 2 4
Automatic Tel.& El.	12½	12½	48/9	..	5 2 6
Babcock & Wilcox	11	11	43/9	—9d.	5 0 6
British Aluminium	12½	10	44/6	..	4 10 0
British Insul. Ord.	20	20	91/3	–½	4 7 6
British Thermostat (5/–)	18½	18½	13/9	..	6 14 6
British Vac. Cleaner (5/–)	12½	10	11/3	..	4 9 0
Brush Ord. ..	Nil	Nil	4/6	..	—
Callender's ..	15	15	72/6	–½	4 2 9
Chloride Elec. Storage	15	15	72/6	..	4 2 9
Consolidated Signal	17	17	77/6xd	+1/9	4 7 8
Crabtree (10/–) ..	17½	17½	29/6	..	5 18 8
Crompton Parkinson Ord. (5/–) ..	30	20	22/6	..	4 9 0
E. K. Cole (5/–) ..	Nil	7	9/6	..	3 13 9
E.M.I. (10/–) ..	Nil	6	13/9	..	4 7 3
Electric Construction	10	10	34/6	..	5 16 0
Enfield Cable Ord.	16½	12½	55/–	..	4 11 0
Elect. Switchgear (10/–)	16	10	20/–	..	5 0 0
English Electric ..	10	10	38/9	..	5 3 0
Ensign Lamps (5/–)	25	25	16/3	..	7 13 10
Ericsson Tel. (5/–)..	25*	22*	41/3	..	2 13 3
Ever Ready (5/–) ..	40	40	31/–	–6d.	6 9 0
Falk Stadelmann ..	7	7½	22/–	..	6 16 4
Ferranti Pref. ..	7	7	27/6	..	5 1 10
G.E.C.:					
Pref.	6½	6½	33/9	..	3 17 2
Ord.	20	17½	82/6	..	4 5 6
Greenwood & Batley	15	13	27/6	..	9 9 0
Hall Telephone (10/-)	15	10	17/6	..	5 14 3
Henley's (5/–) ..	20	20	22/6	..	4 9 1
4½% Pref. ..	4½	4½	21/3	..	4 4 8
Hopkinsons ..	15	15	47/–	..	6 7 10
India-Rubber Pref.	5½	5½	21/3	..	5 3 6
Intl. Combustion ..	32½	30	107/6	..	5 11 6
J. Lucas	15	15	68/9	..	4 7 3
Johnson & Phillips	15	15	58/9	—9d.	5 2 0
Lancashire Dynamo	20	20	66/3	..	6 0 10
Laurence, Scott (5/-)	15	15	11/–	..	6 16 4
London Elec. Wire	7½	7½	28/3	+3/3	5 6 2
Mather & Platt ..	10	10	40/–xd	–1/6	5 0 0
Metropolitan Elec. Cable Pref. ..	5½	5½	21/3	..	5 3 6
Murex	20	20	90/–	–½	4 9 0
Pye Deferred (5/-)..	25	25	15/–	..	8 6 8
Revo (10/–) ..	5	20	25/7½	..	7 16 0
Reyrolle	12½	12½	57/6	..	4 7 0
Siemens Ord. ..	7½	7½	26/3	..	5 14 3
Strand Elec. (5/–)	2	4	3/6	..	5 14 4
S. Smith (1/–) ..	50	37½	7/–	..	5 7 2
Switchgear & Cowans (5/–).. ..	10	15	10/–	..	7 10 0
Tel. Condenser (10/–)	Nil	5	11/3	..	4 9 0
T.C. & M.	10	10	41/3	..	4 17 0
Telephone Mfg. (5/-)	9	9	9/–	..	5 0 0
Tube Investments..	23¾	20	85/–	..	4 14 3
Vactric (5/–) ..	4	Nil	4/3	+3d.	—
Vickers (10/–) ..	10	10	16/3	..	6 3 1
Ward & Goldstone (5/–)	20	20	19/–	..	5 5 3
Westinghouse Brake	10	10	50/–	..	4 0 0
Walsall Conduits (4/-)	55	55	32/6	..	6 15 4
West, Allen (5/-) ..	7½	7½	5/9	..	6 10 5

* Dividends are paid free of Income Tax.

Stocks & Shares (*Concluded from page* 287)

about through sales by holders evidently rendered nervous by the Far East developments as these might affect Cable and Wireless earnings, through the interest which the combine possesses in Eastern Telegraph stock and Eastern Extension shares. That the traffics cannot escape the effect of Japan's activities, and that the assets may also suffer physical damage, is fairly obvious, but whether the fall in prices may not have proceeded too far, is a matter for consideration.

Cable and Wireless 5½ per cent. preference stock is entitled to a half year's dividend in May next, and the ordinary stock will receive a full twelve months' dividend a few weeks later. Last year, Cable ordinary received £4 and up to just lately it had been expected that the 4 per cent. rate would be maintained. At 58½ the yield on the money, on a 4 per cent. basis, comes to £6 16s. 9d. per cent. The 5½ per cent. preference at 96½ gives a return of £5 14s. per cent.

To study the dealing book of a jobber in that market will reveal the reason for the dwindling of the prices, because on the buying side there are so many more bargains than appear on the other side of the same book. The former are mostly in small amounts. Towards the end of last week, a better tendency became apparent in the market.

British Electric Traction

Within the past few days, modest amounts of British Electric Traction preference and preferred stocks have come to market. Of the 6 per cent. cumulative participating preference, there is £500 on offer at 185. The stock is entitled to an additional 2 per cent. non-cumulative dividend over and above the 6 per cent. cumulative interest, and for many years this extra 2 per cent. has been paid by the company. On the basis of the 8 per cent. dividend, the yield at the price mentioned is £4 6s. 6d. and the dividend was covered, according to the last published figures, nine times over. Of the company's 8 per cent. non-cumulative preferred stock, £1,000 is on offer at 175, June and December dividends. This pays £4 11s. 3d. per cent. The annual dividend requires £106,100 and the latest accounts showed £474,000 available to meet it.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1940

7095. "X-ray tube installations." General Electric Co., Ltd., and J. T. Caldwell. April 19th, 1940. (542798.)

8843. "Electric protective arrangements." A. Reyrolle & Co., Ltd., C. H. Lackey and G. G. Scarratt. May 17th, 1940. (542804.)

10106. "Rotary indicating device." Philco Radio & Television Corporation. July 25th, 1939. (542806.)

10862. "Barrier joints or terminations for electric power cables." Standard Telephones & Cables, Ltd., and E. C. Lee. June 25th, 1940. (542842.)

11156. "Railway signalling systems and apparatus." Standard Telephones & Cables, Ltd., A. Brown and T. A. Marshall. July 2nd, 1940. (Addition to 496495.) (542843.)

11635. "Electron-discharge devices of the electron-velocity modulation type." Standard Telephones & Cables, Ltd. December 14th, 1939. (542908.)

12166. "Grid modulating systems for radio or like transmitters." Marconi's Wireless Telegraph Co., Ltd. July 25th, 1939. (542813.)

12204. "Receivers for start-stop printing-telegraph signals." Creed & Co., Ltd., and F. P. Mason. July 26th, 1940. (542777.)

12205. "Escapement devices, particularly for printing-telegraph apparatus." Creed & Co., Ltd., A. E. Thompson and R. D. Salmon. July 26th, 1940. (542778.)

12311. "High-frequency energy transfer circuits." Marconi's Wireless Telegraph Co., Ltd. July 28th, 1939. (542780.)

12342. "Electrical signal wave receivers which incorporate amplitude limiters." Standard Telephones & Cables, Ltd., and W. A. Beatty. July 30th, 1940. (542911.)

13573. "Television systems." Baird Television, Ltd. August 29th, 1939. (542820.)

14056. "Electric relay devices." Sangamo Weston, Ltd. April 8th, 1940. (542821.)

14650. "Arrangements adapted to minimise the effects of the impedance of the earth wire or earth busbar in alternating-current electric circuits." Siemens Bros. & Co., Ltd. and J. H. Mole. September 27th, 1940. (Cognate application, 6/41.) (542847.)

15750. "Ceiling roses or the like for electric lights." W. E. Wade. October 28th, 1940. (542822.)

15986. "Circuit arrangements for operating electric-discharge lamps." British Thomson-Houston Co., Ltd. November 1st, 1939. (542853.)

16113. "Electric switches with blade contacts." General Electric Co., Ltd. and E. H. Croft. November 5th, 1940. (542823.)

16472. "Protective means for electric circuit-breakers." G. W. Davidson, A. E. Emsley and Metropolitan-Vickers Electrical Co., Ltd. November 14th, 1940. (542857.)

16838. "Prepayment electricity and other like meters." Chamberlain & Hookham, Ltd., S. James and L. O. Deacon. November 23rd, 1940. (542858.)

17038. "Processes of preparing esters of methacrylic acid." British Thomson-Houston Co., Ltd. December 1st, 1939. (542860.)

17130. "Electrical highly-inductive apparatus such as power transformers and chokes." Ferranti, Ltd., and J. E. L. Robinson. December 2nd, 1940. (542861.)

18065. "Isolating electric switches." Electrical Apparatus Co., Ltd., and J. R. Walton. December 23rd, 1940. (542863.)

18115. "Transformers." Akt-Ges. Brown, Boveri & Cie. November 23rd, 1939. (542864.)

1941

764. "Telephone exchange systems." Electrical Research Products, Inc. January 23rd, 1940. (542827.)

1685. "Protective devices for lightning arrestors." British Thomson-Houston Co., Ltd. (Tokyo Shibaura Denki Kabushiki Kaisha). February 7th, 1941. (542867.)

1735. "Thermostatically controlled switch devices." British Thomson-Houston Co., Ltd. February 8th, 1940. (542892.)

2200. "Time lag device for use in connection with a tripping device of an electric circuit-breaker." J. G. Statter & Co., Ltd., G. S. Marston and F. Howe. February 18th, 1941. (542893.)

2599. "Electric circuit-interrupting systems." British Thomson-Houston Co., Ltd. February 28th, 1940. (542894.)

3107. "Electro-magnetic coils." Standard Telephones & Cables, Ltd. March 13th, 1940. (542898.)

4075. "Electric circuit-breakers having trip mechanism." G. W. Davidson and Metropolitan-Vickers Electrical Co., Ltd. March 26th, 1941. (542829.)

4769. "Lubricating systems." British Thomson-Houston Co., Ltd. (General Electric Co.) April 10th, 1941. (542830.)

1942

312. "Alternating-current electric circuit-breakers of the gas-blast type. A. Reyrolle & Co., Ltd., D. F. Amer and W. H. Webb. June 17th, 1940. (Cognate application, 313/42.) (Divided out of 542728.) (542920.)

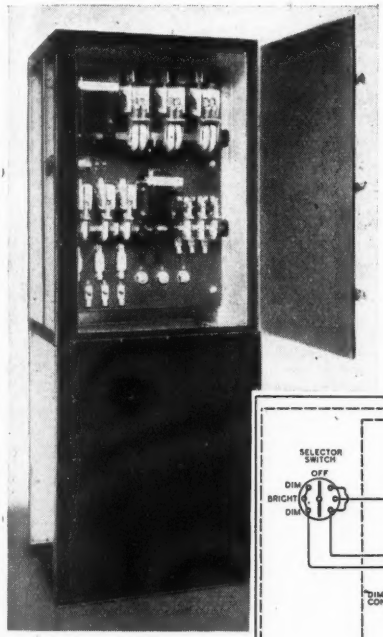
Swiss Power Plan

A *REUTER* message from Berne states that a ten-year plan for the construction of large electrical works in Switzerland, to provide cheap electricity to meet all internal requirements, will shortly be submitted to the Government. Announcing this at the inauguration of an electrified railway in the Canton of Zurich, M. Cellio, Swiss Minister of Railways, said that the proposals provided for an expenditure of 650,000,000 Sw. fr. (about £37,500,000). The scheme, he added, would assist Switzerland's co-operation in the reconstruction after the war. The necessary surveys are to be carried out without delay.

Air-Raid Light Signal

Contactor-Operated Dimming Equipment

VISUAL air-raid precautionary signalling by dimming lamps in works and factories wherein audible warnings are ineffective because of the noise made by processing plant is made possible by equipment

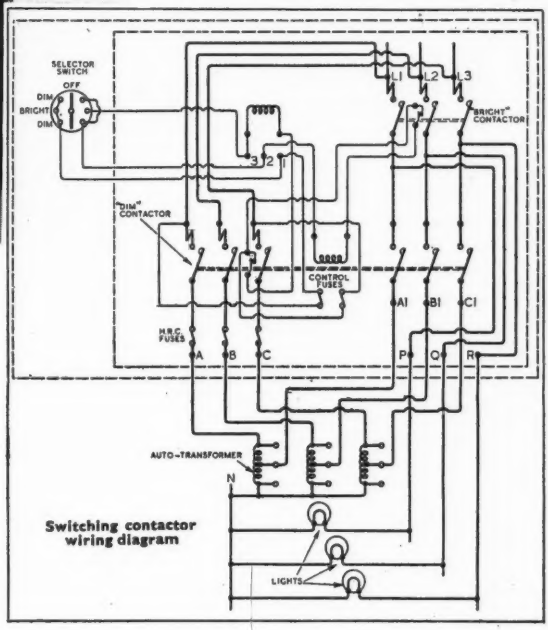


Contactor panel housing, front door open

developed by M. & C. Switchgear, Ltd., Kirkintilloch, Glasgow. A floor-mounted enclosure contains AC main and secondary contactors and three high-rupturing-capacity fuses, all attached to an insulating base. A separate oil-immersed auto-transformer is provided, so that three-phase energy at 440 V and 50 cycles is delivered through the main 450-A, triple-pole contactor direct to the factory's principal lighting distribution board. The secondary contactor is six-pole, of 200 A capacity, and a selector switch by means of which the contactors are operated is mounted on the cover of the enclosure. With this switch in the "bright" position full voltage is applied to the works lighting system by the main contactor, which drops out when the switch is moved to its "dim" position, so allowing the secondary contactor to furnish reduced voltage from the auto-transformer, which is tapped for variation of dimming voltage. The neutral is carried through unbroken.

The selector switch is so connected that the reduced voltage is applied to the lighting system during the initial switching on, and is provided with contacts to give a cycle of "dim" and "bright" signals. Thus the lighting may be cut off entirely during an "alert" or maintained at reduced voltage.

There is a saving in lamp replacements as only half normal voltage is applied at switching on. Also A.R.P. shelter lighting can be obtained by utilising the factory supply at low voltage (secondary batteries only used as a stand-by supply) though this is only possible if general lighting is maintained at the reduced voltage.



Switching contactor wiring diagram

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Cardiff.—March 2nd. Rural District Council Electricity Department. 250-kVA transformer with automatic on-load tap-changing equipment. Specification, etc., from Mr. H. Jackson, electrical engineer and manager, 20, Park Place.

Eccles.—Electricity Committee. Paper and rubber cables for five-year period.—C. V. Johnson, borough electrical engineer.

Irlam.—February 28th. Urban District Council. Electric lamps. Forms of tender from the engineer and surveyor, Council Offices.

Kettering.—March 2nd. Electricity Department. Switchboard extensions, 4,000-kVA transformers, etc. (February 6th.)

Londonderry.—Town Council. March 7th. Annual supplies of house-service cut-outs, joint box compound, meters, electrical accessories, lubricating oils, transformers and kiosks, A.C. motors, cables and cable-covering tiles. Forms of tender and specifications from the Electricity Department, Strand Road.

Marple.—March 4th. Urban District Council. Cover tiles for cables, ducts, joint-box compound and rubber- and paper-insulated cables. Specifications, etc., from Mr. A. E. Griffiths, electricity manager, Council Offices.

Newcastle-on-Tyne.—City Council. Electric lighting and repairs and maintenance on the various housing estates. R. G. Roberts, city architect, 18, Cloth Market, Newcastle.

Weymouth.—March 3rd. Electricity Department. 750-kVA and 200-kVA transformers (February 20th.)

Orders Placed

Bromborough.—Cheshire County Council. Accepted. Electrical work at cooking centre (£444).—S. George.

Glasgow.—Gas Committee. Accepted. Conversion of lighting fittings in the gas engine and turbine houses to explosion-proof fittings.—Electricity Department.

Police Committee.—Accepted. High-frequency radio equipment (revised tender, £9,275).—G.E.C.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ancoats.—Works additions; G. W. H. George, architect, 3, Merston Drive, Didsbury, Manchester, 20.

Ashton Marsh.—Dining room, etc., at works; J. Spencer & Son, builders, Liverpool Road, Penwortham, Lancs.

Bedford.—Improvements, London Road School (£1,400) and cookery centres (£4,950); borough engineer.

Bomersund.—Canteen at colliery; Newcombe & Newcombe, Eldon Square, Newcastle-on-Tyne.

Bristol.—Youth centre, Knowle estate; John Knox, Ltd.

Cheetham.—Works additions; P. Hamer, Ltd., building contractors, 15, Park Street, Swinton, Lancs.

Cheshire.—First-aid posts (£31,000); county architect.

Devizes.—Workshop premises; A. J. Jeffrey.

Durham.—New cleansing station and nursery school, Hebburn, erection of offices at Bearpark School, Durham (£1,690) and alterations to Station Town School (£550); F. Willey, county architect, 34, Old Elvet, Durham.

Folkestone.—Proposed new headquarters for the police; borough engineer, Church Street.

Gainsborough.—British Restaurants at Parish Church Institute and St. John's Hall; surveyor, Council Offices, 6, Lord Street.

Gateshead.—Two garages for the National Fire Service; F. H. Patterson, borough engineer, Swinburne Street, Gateshead.

Hereford.—Day nursery, Bishop's Palace; J. Nash.

Jarrow-on-Tyne.—Rebuilding work at the Mechanics' Institute; D. Glen, builder, Back Queen's Road, Jarrow.

Leicestershire.—Temporary school and kitchen, Glen Parva; County Education Committee.

Levenshulme.—Warehouse and offices, Slade Lane; Allied Supplies, Ltd., 179-189, City Road, E.C.1.

Melton Mowbray.—A.R.P. centre (£1,059); H. Holroyd.

Middlesbrough.—Restaurant at North Ormesby (£1,600); borough engineer.

Miles Platting.—Works additions; H. S. Fairhurst, 55, Brown Street.

Morpeth.—Alterations and additions to the laundry at St. George's Hospital; the County Architect, Mitford Road School Offices, Morpeth.

Newcastle-on-Tyne.—Feeding kitchen, etc., at Dame Allen's Rest Centre (£555); H. Kindred, builder, 371, West Road, Newcastle.

Port Sunlight.—Cleansing station (£2,299); E. J. B. Gould & Son.

Twickenham.—Adaptations at Ludlow House, Seymour Road, Hampton Wick, for day nursery (£850) and civic restaurant at Club, Ashley Road, Hampton (£1,465); borough engineer, Municipal Offices, York House.

Warwickshire.—Day nurseries at Long Lawford and Dunchurch and additional school canteens; A. C. Bunch, county architect, Shire Hall, Warwick.

Wellingborough. — British Restaurants for R.D.C.; H. W. Sheffield, surveyor, Council Offices, 18, Oxford Street.